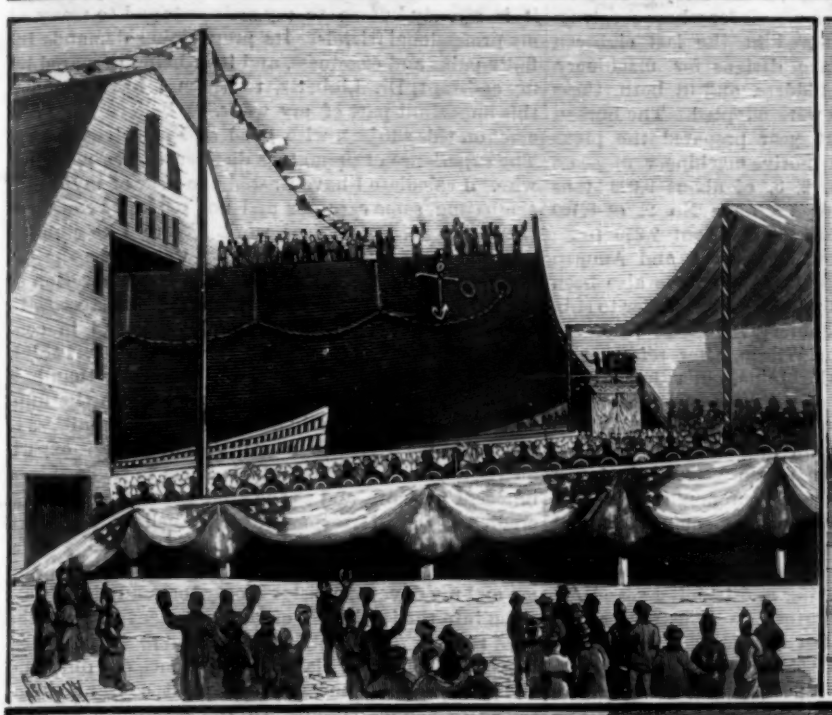
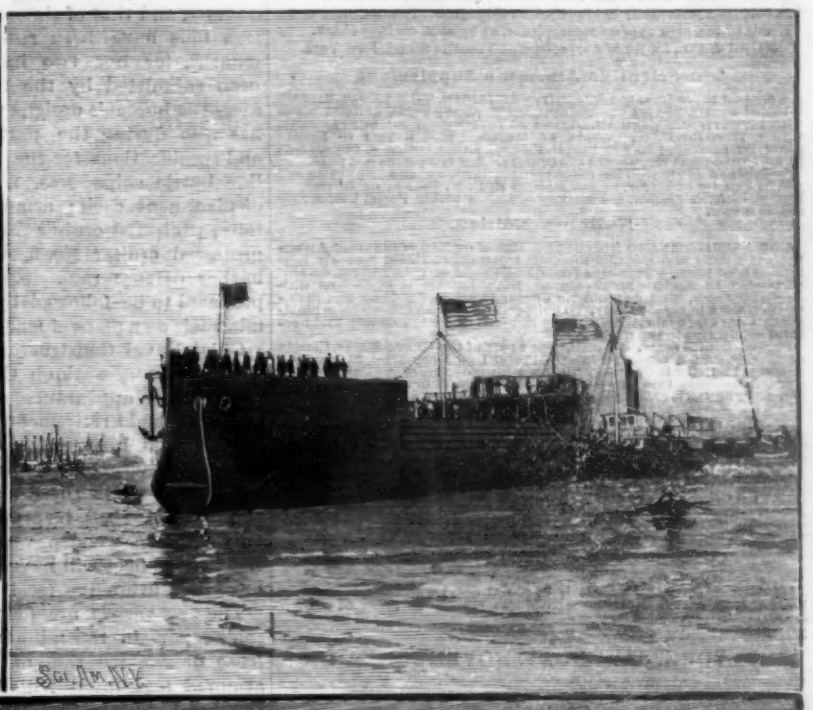
SCIENTIFIC AMERICAN

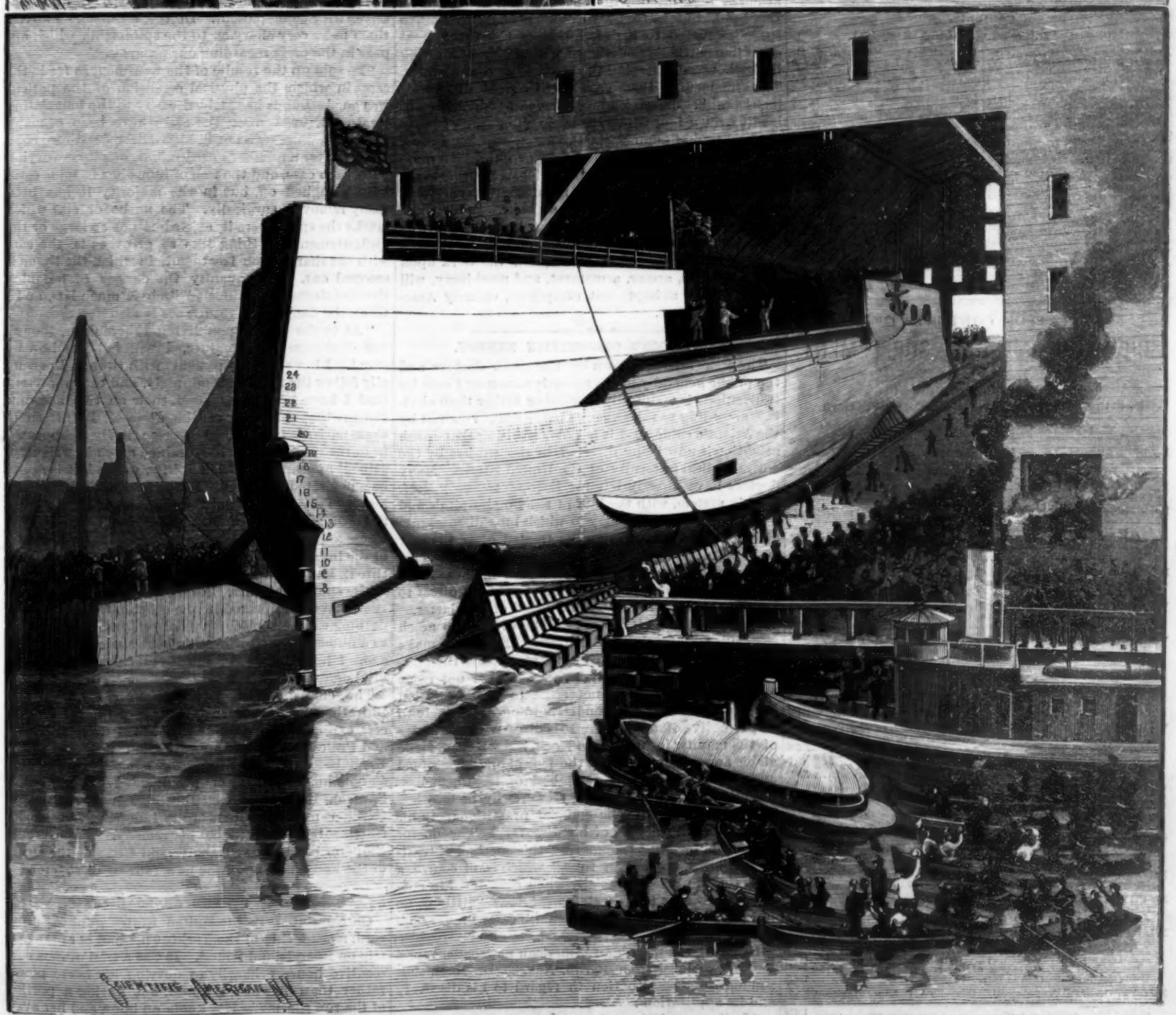
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1890, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIII.—No. 22. ESTABLISHED 1845. | NEW YORK, NOVEMBER 29, 1890. | $3.00 A YEAR. WEEKLY.







THE LAUNCH OF THE ARMORED CRUISER MAINE AT THE BROOKLYN NAVY YARD.—[See page 340.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of seven dollars. To foreign countries within Postal Union, nine dollars a year.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

NEW YORK, SATURDAY, NOVEMBER 29, 1890.

Contents.

(Illustrated articles are marked with an asterisk.)

Accidents, how to treat..... 345
America, date of discovery of... 338
Armor-piercing projectiles..... 344
Ashtabula (Ohio) Harbor..... 345
Books and publications, new..... 346
Bone grafting in a boy's leg*..... 338
Building, cheap, secret of..... 342
Car coupler, Magorden's*..... 339
Chronometers, regulating..... 344
Cod and lobster hatching..... 337
Coke industry, the..... 341
Concord, gunboat, trial trip of... 336
Consumption, remedy, Prof. Koch on his..... 338
Cruiser, Maine, launch of*..... 335
Diving apparatus improvement. 341
Drawbridge, a counterbalanced* 345
Fence making machine, Banks and Belt's*..... 339
Flue cleaner, Watson's..... 344
Fountain, drinking, for Chicago. 344
Glaciers..... 340
Grafting a dog's bone on boy's body*..... 337
Insect bites, cure for..... 339
Inventions, recently patented... 346
Iron ore discov. by lightning.... 342
Locomotive, electric*..... 342
Maine, cruiser, launch of*... 335, 340
Man with a patent..... 342
Navy, new, building the..... 336
Nicaragua canal, work on the..... 337
Notes and queries..... 346
Norway, dredging in*..... 338
Oil, distribution of on rough seas. 344
Patent legislation for a century. 341
Patent sales agency business.... 343
Photograph developing trays..... 340
Photography, amateur (236, 237, 338, 347
Pistol, toy, Blampied's*..... 339
Planets, December position of.. 337
Railway, electric underground, London*..... 342
Schools, free lectures in public.. 345
Sewer gas poisoning..... 344
Shingles, wood, a dip for (305)... 347
Shoe bottoms, staining, (305).... 347
Simalligraph level to facilitate drawing*..... 338
Steamship Spree, new Atlantic.. 340
Time, reckoning..... 344
Water cooler, Hillyer's*..... 339
Wrench, Bunch's*..... 339

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 773.

For the Week Ending November 29, 1890.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AERONAUTICS.—Captive Balloons of the French Navy.—Interesting description of the balloon maneuvers at sea under the auspices of the French navy.—3 illustrations..... 12402

II. AGRICULTURE.—Our Currants.—The different varieties of currants and what the value of the crops should be..... 12397

III. AVICULTURE.—Artificial Incubation.—A very practical subject practically treated, giving the details of the French process of raising chickens.—7 illustrations..... 12400
Artificial Incubation in Egypt.—By Consul-General CARDWELL.—An interesting supplement to the above, describing the Egyptian process.—1 illustration..... 12401

IV. BIOGRAPHY.—WILLIAM H. CILLEY.—A tribute to the life work of the great engineer, and notes of his work in South America..... 12404

V. CHRONOLOGY.—The Quadri-Centenary of America's Discovery.—By S. W. BALCH.—A very curious difficulty in determining the exact date of the termination of Columbus' voyage..... 12397

VI. CHEMISTRY.—A Method of Detecting Chemical Union of Metals.—By Dr. G. GORE.—A method for determining electrically the laws of combination of metals..... 12403
Liquid Chlorine.—By A. E. TUTTON.—The determination of the data of liquid chlorine, with a description of the interesting peculiarities of this substance..... 12401
On Sulphites, their Stability and Preservation.—By JOSEPH C. BELCHER.—A valuable paper to photographers, treating of the nature of sulphites..... 12402

VII. ELECTRICITY.—Electro-Welded Projectiles.—The new application of the Thomson electric welding process to the production of shells for guns of large caliber..... 12406
The Electromagnet.—By Prof. SILVANUS P. THOMPSON.—The continuation of Prof. Thompson's exhaustive lecture on this interesting subject.—4 illustrations..... 12407

VIII. MEDICINE AND HYGIENE.—Constipation, its Nature and Treatment.—By C. L. DODGE, M.D.—A practical treatise on the causes and cure of this complaint..... 12406
New School of Medicine of Paris.—A description of the magnificent institution approaching completion at Paris.—9 illustrations.. 12404

IX. METALLURGY.—Electrolytic Production of Pure Iron.—A new process recently invented by Dr. STEPHEN H. EMMENS, the well known inventor of the explosive "emmensite."..... 12406

X. MISCELLANEOUS.—Ormonde and Salvator.—Two famous race horses, their peculiarities and achievements.—2 illustrations..... 12403

XI. PHYSICS.—Physics at the British Association.—An interesting review of the reports and papers before section A of the British Association at its recent meeting..... 12402

XII. RAILROAD ENGINEERING.—A Proposed Railroad Approach to New York City.—A proposed all-rail connection between New Jersey and Westchester County, New York, to connect the South and West with New England.—1 illustration..... 12405
Economy of Steam Heating of Passenger Cars.—How to run steam heating apparatus on cars.—Its relative economy..... 12405

XIII. TECHNOLOGY.—Lubricating Oils.—By A. C. J. CHARLIER.—A valuable treatise on this important subject, with notes on tests of lubricants..... 12399
Manufacturing Smoke.—By GEORGE E. DAVIS.—The smoke question, how to prevent the formation of smoke or how to get rid of it when formed..... 12403

BUILDING THE NEW NAVY.

Contemporaneously with the launching of the new cruiser Maine at a United States government shipyard comes the annual report of the Engineer in Chief, showing how the entire work of rebuilding or constructing a new navy, worthy of our position as a nation, has progressed during the past year. "It is a matter of pride for the Bureau of Steam Engineering," says Engineer Melville, "to be able to state that, except for the Newark, which has engines very like those for the Philadelphia, built by the same firm; the Concord and Bennington, whose engines are copies of the Yorktown; and the Texas, purchased abroad, all the machinery now building for the navy is from its designs; and that of sixteen vessels for whose construction bids have been received in the last eighteen months, for but two have designs for machinery been submitted by the bidders, and in both these cases the bureau's designs were adopted. The bureau has also during the past year prepared the plans and specifications for the motive machinery of coast line battle ships Nos. 1, 2, 3, of about 9,000 tons displacement each; armored cruiser No. 2, of 8,100 tons; protected cruiser No. 12, of about 7,350 tons; protected cruiser No. 6, of 5,500 tons; and Ammen harbor defense ram. Specifications have also been prepared to be followed by bidders who prefer to submit their own plans of machinery."

Chief Naval Constructor Wilson, after referring to the satisfactory work on the Maine, notes that "With the gradual appearance of the new steel navy has come the rapid retirement of the wooden fleet. When the Chicago, Boston, Atlanta and Dolphin were begun, the serviceable wooden steam vessels numbered thirty-seven; now there are eleven new steel vessels and one first-class torpedo boat in commission, and only eighteen wooden vessels. In about seven years the wooden fleet will have practically disappeared, or have been utilized as receiving and training vessels."

The new vessels are described in Constructor Wilson's report in the minutest detail. The harbor defense or Ammen ram of 2,050 tons is to be heavily armored and fitted with a powerful removable steel ram-head, but is to be without armament. Much space is devoted to a description of the three great coast line battle ships designed with a view of meeting in battle vessels carrying the heaviest guns and armor. The armament of these vessels will consist of four 13-inch 35-caliber breech-loading rifles, eight 8-inch breech-loading rifles, four 6-inch breech-loading rifles, twenty 6-pound rapid-fire guns, six 1-pounder rapid-fire guns, two Gatling and six torpedo tubes or guns. All modern appliances for offensive and defensive purposes are carried, and the coal capacity is sufficient to carry the vessel 16,000 miles at ten knots an hour. In all these new vessels the requirements have been as severe as those of any nation in the world, and in most cases have exceeded those of all others, and the work upon them, in hulls, armor, armament, and machinery, will be, with a few unimportant exceptions, entirely American throughout.

PROF. KOCH'S CONSUMPTION REMEDY.

The great interest shown by European doctors and the public generally in the recently announced cure for tuberculosis is manifestly increasing rather than abating, according to the accounts being daily received by the Atlantic cable, and it is not surprising that much attention is now being directed to the subject by the entire medical fraternity of the United States. Many doctors have already left for Europe to study Prof. Koch's system, with the idea of starting hospitals and sanitariums in this country in which lung diseases and all cases of tuberculosis may be treated after the new plan. At least one consumptive patient, whose case has been carefully diagnosed, and both of whose lungs are affected, has also been sent for treatment direct to Dr. Koch, with the cabled consent of the latter.

In the meantime it is well not to expect too much from this apparently great discovery. Those who make too large assumptions on its account, and are then disposed to discredit it wholly because it does not come up to such standard, do not come to a consideration of the subject with such understanding as is likely to be promotive of any good. It is directly the opposite of the manner in which Dr. Koch himself has made all his announcements, and the fear of an ill-conceived and improper use of his method of treatment has, doubtless, been the principal reason why he has thus far withheld, except from eminent practitioners in his confidence, the details of his discovery. The doctor only claims complete success by this method of treatment when "applied in time," which is, of course, a very elastic phrase, especially when considered in connection with the further statement that "little or no improvement is to be expected in cases of very advanced disease."

In an interview with an American newspaper representative, cabled from Berlin, Nov. 20, Dr. Koch thus summarizes the situation in regard to his discovery and its application:

"I discovered the tubercular bacillus eight years ago. It was at first warmly disputed, but is now generally admitted. I have ever since then been engaged in the study of the deadly parasite, and have been endeavoring to obtain an inoculating fluid which would kill the bacilli and bring about a sufficiently strong and healthy local reaction to expel them from the body without at the same time destroying healthy organisms. Of course, this latter has been the difficulty. I believe I have it here," and Prof. Koch held up to view a vial of the inoculating fluid. It is of a dark brown color, and easily decomposed.

"There is very little use of my saying just now what the inoculating fluid is or how I obtained it. It has cost me years of my life, and I propose to retain the secret for a few weeks longer from publicity, though it is already known to my assistants and to many of my professional friends. Its preparation demands infinite pains and exactness, and it is being prepared by my assistant, Dr. Libbertz, to whom I have confided this important part of my work. I believe I am discreet on this subject, with good and sufficient reason. The experience of premature disclosures has made me wise. I calculate I have wasted one year of my life in combating some captious and not perfectly conscientious critics of my original work. Were I to publish how the first stage of the discovery was made, the exact ingredients and the method of the preparation of the fluid, thousands of medical men from Moscow to Buenos Ayres would to-morrow be engaged in concocting it, and injecting it, too, for that matter. I think I am right in supposing, as I do, that more than half these gentlemen are incompetent to prepare the fluid which, with special study and special opportunities, it has taken me a year to prepare. Then these experiments might cause incalculable harm to thousands of innocent patients, and at the same time bring into discredit a system of treatment which, I believe, will prove a boon to all mankind. If experiments now being made turn out successfully, then the medical world will find me and my devoted assistants only too ready to initiate them into the intricacies of the treatment without the least reserve. But until then, although it seems perhaps selfish, I really claim it is at once our duty and the purest unselfishness. They must content themselves with being patient. In the meantime I advise them to be very chary as to the statements which appear in the press regarding our progress.

"To sum up the results of the treatment so far in the cases in which the physical condition of the patient was good—Lupus has yielded easily to the inoculating treatment, even when the cases have been of many years' standing. The bacilli have been destroyed completely after a number of injections, of course varying with each case, and the web of lupus has in some cases been sloughed off, but in the majority it has been easily removed surgically. The narbe or star which marks the spot where it existed is not so large or the disfigurement anything like so great as is the case with the sharp spoon treatment, in which the tissue is scooped out. Consequently the danger of lessening the usefulness of the affected limb is much less, and I think the danger of a recurrence is also lessened.

"As to the effect upon living tuberculosis, though the disclosure is premature, I will tell just how we stand. I have twenty patients with whom I personally follow the treatment minutely, and they represent (and I have, of course, chosen them on this account) the graduated stages of the disease. In fifteen of these patients the bacilli have completely disappeared from the sputa. They have gained much in weight, in general appearance, and in spirits, which last is not to be a neglected symptom. In the remaining five cases I regret to say there is not the slightest indication that the ordinary course of the disease has been stopped. These are cases in which I found already large cavities in the lungs. In these the cough, the rattle in the throat, and the almost undiminished number of bacilli in the sputa continues. All of these symptoms, I repeat, have disappeared in the other cases. Of course, nothing can be considered final yet, the first-injection to a human being having only been made seventy days ago. I hope for good results in all cases in which the vital organs are intact."

The eminent Vienna physicians, Nothnagel and Billroth, who have been informed of the whole process, express themselves as satisfied of its great value, and Professor Virchow appears as an advocate of Dr. Koch before the Berlin Medical Society, while Drs. Bergmann, Fraentzel, and William Levy, and Staff Surgeon Koehl, are contributing signed articles to German medical papers fully indorsing Dr. Koch's statements in regard to his remedy. The German Emperor has bestowed the Grand Cross of the Order of the Red Eagle upon the now famous discoverer.

TRIAL TRIP OF THE GUNBOAT CONCORD.

On November 19, the United States gunboat Concord, a sister ship of the Yorktown,* had her first trial trip on Long Island Sound. It was a trial of four consecutive hours, primarily to develop her horse power rather than her actual speed, but during a portion of the run she made 17¼ knots an hour, and her aver-

* For illustration and full description of the Yorktown see SCIENTIFIC AMERICAN SUPPLEMENT 667.

age for the entire trip was only a trifle under 17 knots. The contract calls for a developed horse power of 3,400, which, it is supposed, it will require another trial to demonstrate in her engines, as difficulty was experienced with her feed pumps, but the speed and steadiness of the vessel exceeded anticipations. She is said to have glided over the water as easily as though there had been no resisting medium, there not being a tremor felt in her light steel hull, even when the vessel was going at her highest speed.

GRAFTING A DOG'S BONE ON A BOY.

On November 16, at the Charity Hospital, New York City, a portion of a living dog's foreleg was engrafted into a boy's leg, to take the place of a bone that was lacking. There had been congenital malformation of the boy's leg, which had been operated upon before, and was broken intentionally by the surgeon, but union between the bony fragments had failed to take place. The boy and the dog were bound on a cot, as shown in the illustration, both under the influence of anæsthetics, but the dog, which was a black spaniel, was incased in a hardened plaster of Paris cast, his right foreleg and head and tail being free. The boy's leg showed an abnormal degree of immobi-

lity and shortening, and just above the ankle was a space that entirely lacked bony tissue. Dr. A. M. Phelps, professor of orthopedic surgery in the University of New York, performed the operation, which consisted of engrafting the ulna of the dog's foreleg, the homologue of a man's arm, into the wound.

The boy's leg was shaved, washed with soap and water, and scrubbed with a brush of bristles. Squibb's ether was poured on the skin in order to neutralize the fatty secretions. Then came the aseptic measures. The skin was scrubbed with a solution of corrosive sublimate, and towels dampened with the solution were placed around the leg and ankle, leaving only a small portion exposed to the operator. The leg was seen to be scarred, the result of former operations. Every instrument was kept in an antiseptic solution. The cicatricial tissue was carefully removed, and the ends of the bones exposed to view. All bleeding during the operation was prevented by an Esmarch's bandage above the knee, which effectually compressed all the blood vessels of the leg. All newly formed tissue was scraped away. The periosteum of the bone was carefully pushed back with a periosteome. A nutrient artery in the bone was prevented from bleeding by a wooden plug made from a match. All the vessels were tied, and then the Esmarch bandage was removed. So perfectly had this controlled the blood vessels that only a small amount of oozing occurred, which was readily stopped with boiling hot water. It being so near the ankle joint, great care had to be exercised in order not to cut into the joint. A plaster bandage was then put on from the thigh to the base of the toes, being left open at the point of operation.

The dog's leg was first denuded of hair and rendered thoroughly antiseptic. Here comes a delicate part of the operation. Animals are more susceptible to an anæsthetic than a human being, and great care has to be taken that the animal does not die, for it is a live, not a dead, dog bone that is wanted for the void in the boy's leg. The surgeon cuts down into the dog's leg at a point where a dog's knee ought to be. The graft must be nourished, and to insure nutrition the keenest knowledge of the distribution of arteries in the canine anatomy is essential. The surgeon finds it necessary, and does preserve that part of the interosseous artery from which the nutrient artery of the bone makes its exit. The head of the ulna, one of the bones of the dog's forearm, is sawed off. One and a half inches below this the nutrient artery is given off, with its numerous ramifications throughout the bony tissues. The next division of the bone must be an inch and a half below. This severs the interosseous artery, but it is easily tied, and that prime factor, the nutrient artery, is saved. In his hands the surgeon now holds a piece of bone an inch and a half long. It is separated from the bony parts of the dog, but connected by flesh and those life-giving ducts, the arteries.

All is now ready, and the dog is placed alongside the leg of the boy, his head toward that of the boy. Holes are bored in the ends of the bones in the boy's leg, and silver wires are passed through, connecting the two parts loosely. The graft is next dropped between these two extremities, and medullary portions of the boy's bone are made to fit over an aluminum peg. The silver sutures are drawn tight and tied. The skin and flesh flaps of the dog's leg are sewed firmly to the sides of the wound in the boy's leg and it is dressed antiseptically. Two long rods of iron are bent to form a protection over the wound. They are firmly bandaged to the body by plaster of Paris bandages, and are made to allow the surgeon to look at his dressing. Last of all comes the firm strapping of the dog to the boy's leg. This is done by broad bandages of plaster of Paris. The vocal chords of the dog have been cut, and this operation, a painless one to the dog, will relieve the boy from the annoyance of frequent whinings. Besides, frequent injections of morphine will prevent the canine from becoming restless.

This ends the operation so far as the surgeons are concerned, it being intended to keep the dog, if living, ten or twelve days in the position shown. The dog is fed with milk and water, and morphine is injected into him to keep him quiet. For the first few days, at least, after the operation, the patient is said to have been doing well. The case has attracted wide interest, the novelty of a canine bone formation growing as a part of a man's leg presenting to the medical profession especially an attractive field for future investigation.

WORK ON THE NICARAGUA CANAL.

Recent cable advices report that work is being energetically pushed on the Nicaragua Canal, and that over $3,000,000 has been expended during the past twelve months. The pier at San Juan del Norte has been extended 700 feet, and where in last May was dry land there is now reported to be ten feet of water in the channel.

Of the plant bought from the Panama contractors, there are now six dredges and ten lighters in the harbor, in addition to an immense amount of the machinery, tools, supplies, and material delivered on shore. There are also two large suction dredges, which were sent from Charleston, S. C. Two of the dredges are engaged in deepening the channel, and within thirty days will give a sufficient depth of water to allow the entrance into the harbor of the regular steamers plying between New York and San Juan del Norte, so that they can discharge in quiet waters. For twenty-five years all vessels have been obliged to lie outside and discharge by lighters. The route of the canal has been cleared from the harbor to the divide cut.

The railroad toward that point is completed for ten miles of the distance, and is used for transportation of stores and mattresses for filling the pier. A trestle bridge across the harbor is in course of construction and is near completion. The machine shop, equipped with the best modern machinery and tools, to meet the requirements of the work, is also rapidly nearing completion. An aqueduct twelve miles long, to bring pure water from the mountain streams, is being laid. Offices, hospitals, and quarters for employes of the company adequate to the present needs have been erected. Several millions of feet of lumber have been received from Atlantic and Gulf ports, and cargoes are continually arriving.

Payment has been made for the right of way between the lake and the Pacific Ocean. The work of clearing the route on that side of the lake has been commenced, and a party of engineers has been engaged locating the railroad there. The force of canal employes numbers at present 1,500 men, and the chief surgeon's report shows a most satisfactory operation of the sanitary service.

It is reported that there has not been a single death from any febrile or enteric disorders among the whole force of the canal employes since the commencement of the work.

HATCHING COD AND LOBSTER.

Following in the line of scientific investigation first opened by our Professor Baird, Mr. Adolf Nielsen, Superintendent of the Newfoundland Fisheries Commission, has established what appears to be a most successful hatchery for the propagation of cod and lobster in Trinity Bay. The ova of the cod floats, while that of the lobster sinks to the bottom, the eggs of the cod being very delicate, and cod hatching much more difficult than lobster hatching. Great care is needed in supplying the cod ova with constantly renewed pure salt water of a certain degree of salinity and density during the hatching time. During May and June 700 spawning codfish, in various stages of ripeness, were secured, and placed in pounds surrounded with wire netting to which sea water had free access, and fed on the bait in season, such as herring, caplin, and squids. Up to the end of July 33,000,000 cod ova were collected, of which 17,000,000 were hatched and the young fishes placed in good and healthy position in the waters of Trinity Bay. The hatchery has a capacity for hatching 300,000,000 cod in one season. The success in lobster hatching has been even more striking. From various near-by factories over 20,000,000 lobster ova were obtained, and of these, 15,000,000 were hatched and planted. In the work 432 floating incubators were employed—small wooden boxes anchored in suitable localities to be in constant motion in sea water, and requiring the attention of twenty-four men. The returns from fourteen stations show that over 400,000,000 lobsters have thus been hatched and planted this season. There are now about 200 lobster factories or canneries in operation on the island of Newfoundland, but it is fair to presume that, with artificial propagation carried on at this rate, there is no limit to the number which may find employment there in the future without depleting the supply.

POSITION OF THE PLANETS IN DECEMBER.

VENUS

is evening star until the 3d, and then morning star. She wins the first place on the planetary annals of the month, for, during its progress, she passes one of the great epochs in her course. This event is her superior conjunction with the sun on the 3d, at 11 h. 24 m. P. M., when, passing beyond the sun, she reappears on his western side to commence the role of morning star. The fairest of the stars will no longer be seen in the glowing west after sunset, but will soon be found shining in the east before sunrise, growing larger and increasing in luster with every evening's reappearance, until, at the end of the month, she nearly reaches her most brilliant point, rising about three hours before the sun. Venus makes a close conjunction with the waning moon on the 11th, at 1 h. 35 m. A. M., being 36′ north. Planet and crescent are, however, too near the sun to be visible, even if they were not below the horizon at the time of the conjunction.

The right ascension of Venus on the 1st is 16 h. 48 m., her declination is 23° 39′ south, her diameter is 64″.9, and she is in the constellation Scorpio.

Venus sets on the 1st at 4 h. 34 m. P. M. On the 31st she rises at 4 h. 33 m. A. M.

JUPITER

is evening star, and reigns supreme among the glittering hosts that bestud the western sky in the early evening. He has parted with his companion, Mars, the two planets making a most interesting celestial picture when in conjunction on November 18, as they hung side by side from the dark background of the sky. Jupiter is in conjunction with the four days' old moon on the 15th at 9 h. A. M., being 3° 44′ north. Planet and crescent will be fair to see on the evening of the 14th.

The right ascension of Jupiter on the 1st is 20 h. 44 m., his declination is 18° 54′ south, his diameter is 34″.4, and he is in the constellation Capricornus.

Jupiter sets on the 1st at 8 h. 49 m. P. M. On the 31st he sets at 7 h. 22 m. P. M.

MARS

is evening star. The interesting feature to be noted in his course is the increasing distance between him and Jupiter. Mars is 10° east of his rival on the 1st, and 25° east of him on the 31st. Mars is in conjunction with the moon on the 16th at 3 h. 28 m. P. M., being 4° 14′ north.

The right ascension of Mars on the 1st is 21 h. 25 m., his declination is 16° 39′ south, his diameter is 7″.2, and he is in the constellation Capricornus.

Mars sets on the 1st at 9 h. 40 m. P. M. On the 31st he sets at 9 h. 37 m. P. M.

SATURN

is morning star. He is in quadrature with the sun, being 90° west of him on the 8th at 7 h. P. M. He will rise two hours before midnight, when the month closes, and may be easily found at that time coming up in the east. He is in conjunction with the moon on the 4th, the day of her last quarter, at 2 h. 11 m. P. M., being 3° 44′ south.

The right ascension of Saturn on the 1st is 11 h. 13 m., his declination is 7° north, his diameter 16″.6, and he is in the constellation Leo.

Saturn rises on the 1st at 0 h. 1 m. A. M. On the 31st he rises at 10 h. 6 m. P. M.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 28th at 7 h. A. M., being 19° 38′ east of the sun. He then sets an hour and a half after the sun, and is visible to the naked eye in the west about three quarters of an hour after sunset. He must be looked for about 2° north of the sunset point.

The right ascension of Mercury on the 1st is 17 h. 4 m., his declination is 24° 31′ south, his diameter is 4″.8, and he is in the constellation Ophiuchus.

Mercury sets on the 1st at 4 h. 46 m. P. M. On the 31st he sets at 6 h. 3 m. P. M.

NEPTUNE

is evening star. A telescope will bring him into the field about 4° northwest of Aldebaran. His right ascension on the 1st is 4 h. 15 m., his declination is 19° 33′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 6 h. 39 m. A. M. On the 31st he sets at 4 h. 37 m. A. M.

URANUS

is morning star. His right ascension on the 1st is 13 h. 51 m., his declination is 10° 49′ south, his diameter is 3″.5, and he is in the constellation Virgo.

Uranus rises on the 1st at 3 h. 40 m. A. M. On the 31st he rises at 1 h. 49 m. A. M.

Mercury, Jupiter, Mars, and Neptune are evening stars at the close of the month. Venus, Saturn, and Uranus are morning stars.

THE SIMILIGRAPH LEVEL.

A recent work by Mr. Guiot, an artist, and Mr. G. Pillet, professor at the School of Fine Arts and the Polytechnic School, on landscape drawing from nature, has suggested to Captain Billioque the idea of constructing a simple and portable instrument that permits of performing rapidly and accurately all the operations of fixing the points and of the perspective outlining of a drawing, and that too without much knowledge of the laws of perspective. In landscape drawing from nature, it helps one to place datum points and the principal lines very accurately, and the draughtsman can afterward put his own work into the sketch and give it the stamp of originality that befits it. His picture will always appear very true to nature.

Fi . 1.—FINDING THE HORIZON.

Fig. 2.—TAKING THE DIRECTION OF A LINE SEEN FORESHORTENED.

The similigraph level, as the instrument is called, consists of two graduated rules. One of these, A (Fig. 3), contains a slot forming a slide. Suspended at its upper part by the thumb and forefinger of the left hand, and weighted at the bottom, it gives the vertical. The other rule, B, is movable around a bolt fixed upon a slide, C, which moves in the slot of the rule, A, with respect to which it is capable of taking all positions. It may be rendered immovable in these various positions by tightening the nut, E. This latter is solid and is polished in order that it may act as a mirror. Two stops, P, permit of placing the rule, B, in a position at right angles with the rule, A. This rule, B, contains two apertures in which are stretched horse hairs that correspond to the center of the mirror.

Let us now see to what uses the instrument is put. For graphic drawing it serves as a T-square, set square, sliding square, and double decimeter, and permits of forming parallels, of making symmetrical angles, and of bringing angles and straight lines directly to their relative position. It thus aids in the copying, enlarging, and reducing of drawings.

In the field, it gives the horizon over a very wide extent, and it serves as a finder, a plumb line, and a level. It permits of transferring directly to the drawing the foreground lines and the verticals in proportional length and true direction, and the vanishing lines in direction and in length proportional to the foreshortening for the point of view occupied by the observer. In topography, it serves for calculating gradients, it permits of tracing *in situ*, so to speak, the curves of the level before the observer's eye, and finally, it provides a means of leveling a large number of distant points from a single station. It would take too long to give the details of all these operations, and we shall confine ourselves to pointing out briefly the principal ones.

To Find the Horizon (Fig. 1).—Suspend the instrument in front of the right eye, after fixing the movable rule, B, against the upper stop, P. Raise or lower the hand until the eyeball is seen reflected in the center of the mirror. Then glance at the hair that covers the horizon. This is also the method of leveling several points.

To Trace on a Drawing a Ground Line Seen Foreshortened (Vanishing Line) (Fig. 2).—Hold the instrument suspended with the left hand, loosen the nut a little, observe with the left eye the straight line that it is desired to take the direction of. Raise or lower the left hand, and cause the movable rule to pivot, with the right hand, until one of its edges covers the line sighted. Then tighten the nut. It now only remains to make the rule, A,

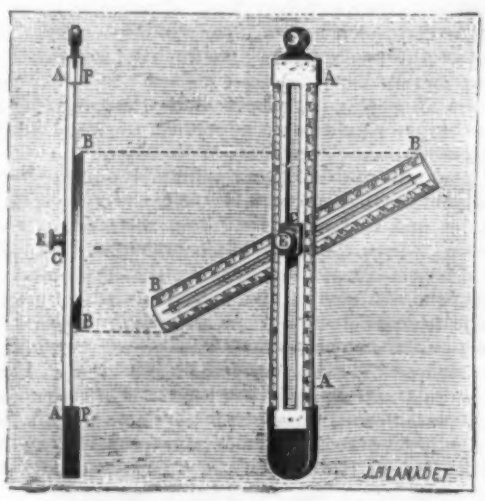


Fig. 3.—BILLIOQUE'S SIMILIGRAPH LEVEL.

coincide with a vertical of the paper and to draw a line along the rule, B.

The two rules fold up, and the instrument can be put into the pocket.

The similigraph level is called upon to render great services to the teacher as well as to the pupil.—*La Nature.*

When was America Discovered?

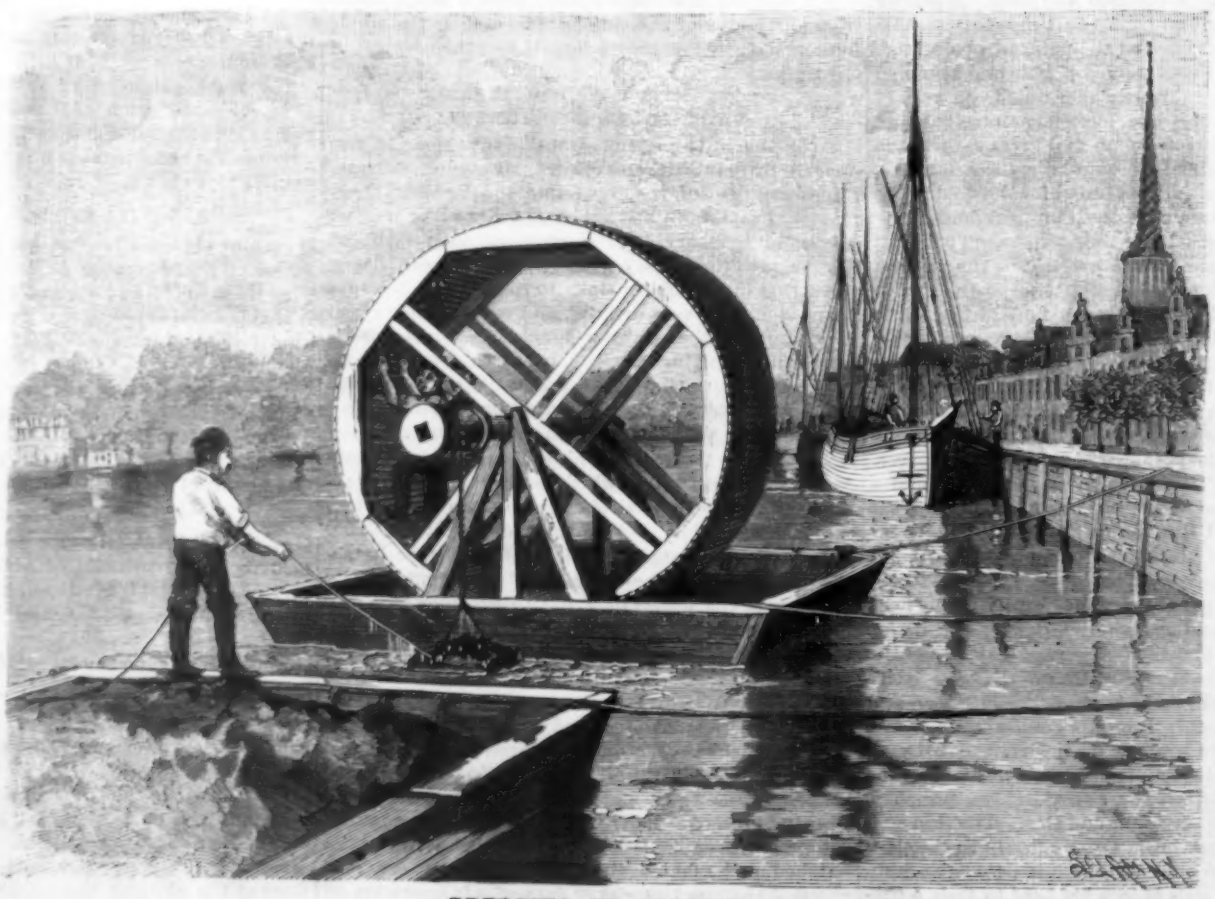
As the time is fast approaching which has been set for the celebration of the above epoch, it becomes of interest to know accurately when it happened. That the above statement is not a mere truism is shown in an interesting paper by Mr. S. W. Balch, which we publish in this week's SUPPLEMENT, 778. In the confusion of new and old times, and of different years, Mr. Balch shows that it is far from easy to determine the exact anniversary of Columbus' first sight of our shores. Four hundred years ago many discrepancies existed in the times of celebration of Christmas, and there is even a possibility that the year should be 1491 or 1493. If the latter, it would certainly suit the convenience of the organizers of the exposition at Chicago. The original paper in our SUPPLEMENT must be consulted for full elucidation of the interesting problem.

DREDGING IN NORWAY.

The methods in common use in Norway to-day are about as primitive as they were in this country fifty or a hundred years ago. We find the same simple and clumsy agricultural implements, the same rude mechanical devices. This is said only of the more remote agricultural districts, however, as in the larger and richer farms the same harvesting, reaping and mowing machines are to be found that are met with on prosperous farms in this country. This is due in a great measure to the great number of Norwegians who have come to this country and, after residing here a number of years, have accumulated enough means to return to their own country for the remainder of their days, and have taken back with them the new ideas that residence in this country has taught them. It is a matter of pride to the American to observe that nearly all the agricultural machines in use there are of American manufacture or model.

The Norwegian is rather backward in getting hold of modern methods, however, owing to the fact that he is limited in his resources rather than that he lacks the push or enterprise to introduce improved appliances. Coal is a luxury. Manual labor is very cheap, the result being that, as a rule there, man is cheaper than steam.

This fact is illustrated by a curious machine for dredging docks and harbors that may be seen sometimes in Norway. An enormous wheel similar to the wheel of a treadmill is mounted upon a frame raised at the sides of a scow. A drum for carrying the chain to which is attached the dredging scoop is mounted upon one end of the shaft of the wheel. Two men are sufficient to rotate the wheel and raise the scoop with its load. With a wheel some nine feet in diameter, the leverage is so great that an enormous load can be raised without difficulty.

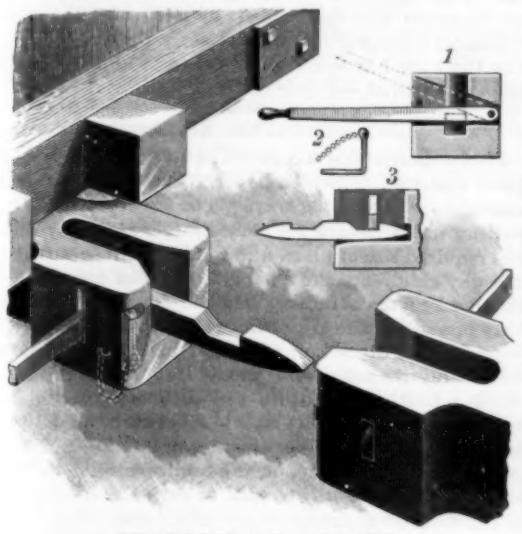


DREDGING IN NORWAY.

IT has been suggested that the study of the influence of diet and habit upon the color of hair in different nations of men may cause discoveries by which the color of the hair in the human race may be modified by judicious treatment.

AN AUTOMATIC CAR COUPLER.

The illustration represents a simple form of car coupling which has been patented by Mr. Holiver Megorden, of Weiser, Idaho. The drawhead has a front opening adapted to receive one end of a coupling link, the latter having at each end a head with shoulders on top. These heads are adapted to be engaged by a transversely extending lever, fulcrumed at one side of the opening, as shown in the sectional view, Fig. 1, the lever extending through a transverse slot in the drawhead to one side of the car. Fig. 3 is a sectional view of the lever in engagement with the coupling pin. The

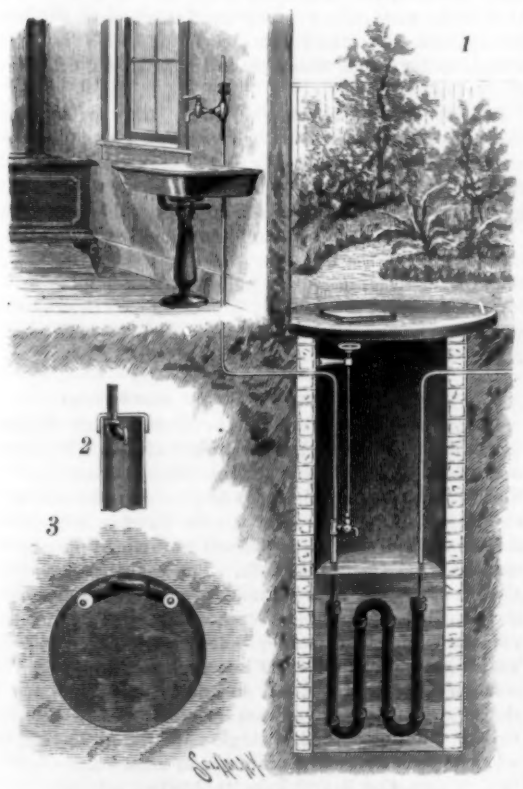


MEGORDEN'S CAR COUPLING.

lever is locked in place by a pin, shown in Fig. 2, the pin being connected to the drawhead by a chain, and having a downwardly extending arm on its outer end adapted to pass into a vertical recess near the front of the drawhead at one side of the opening. In coupling cars this pin is removed, when the entering link in passing in raises the lever until the latter drops over its shoulder. To uncouple, the pin in either drawhead is removed, when the lever is raised and the pin inserted under it to hold it in elevated position, as shown in dotted lines in Fig. 1.

A DEVICE TO SUPPLY COOL WATER.

The accompanying illustration represents an arrangement for cooling the water supplied by a water works system or other source, under a head, by pass-



HILLYER'S WATER COOLER.

ing the water through pipes placed in a well, the water of which has a low temperature, means being provided for relieving the pipes of sediment and conducting the cooled water to the desired point. In the well, as shown in Fig. 1, is submerged a coil of pipe of large diameter, the manner in which the inlet pipe leads to which being shown in Fig. 2. The coil is arranged at the side of the well, as shown in the horizontal section, Fig. 3, so that water may be drawn from the well by a bucket or pump, if desired, and the coil is designed to be of such capacity, according to the average quantity of water to be drawn, that all the incoming water will remain in the coil a sufficient time to be cooled. Any other desired form of coil or casting may be used instead of the one shown, according to the capacity called for. The outlet or discharge pipe leading to the inside of the house is much smaller than the inlet pipe, whereby water may be delivered at about the temperature of the well. At the lower end of the discharge pipe, and connecting it with the coil, is a short pipe of larger diameter, the latter pipe being provided with a valve, whereby water may be drawn rapidly through the coil to remove all sediment which may be deposited therein.

For further information relative to this invention address the patentee, Mr. George Hillyer, Atlanta, Ga.

A SIMPLE FENCE-MAKING MACHINE.

The illustration represents a simple form of machine, patented by Messrs. G. L. Banks and P. P. Belt, by which, it is designed, an inexperienced person may conveniently and cheaply construct a fence of a series of slats or laths held in place by strands of wire. The body of the device is preferably of metal, and in its back has a longitudinal recess, a vertical rack bar sliding between its sides having teeth from top to bottom on one edge and teeth centrally on the opposite edge. Opposite a central recess in the body are brackets in which is pivoted a toothed segment, from which extends an operating handle, the teeth of the segment engaging the central rack teeth. On the other side of the body are casings in vertical alignment, in each of which is a loosely fitted pinion adapted to engage the teeth of the long rack bar. The strands of wire to be used in making the fence are each fastened by one end to a post, and at their opposite ends to any suitable form of tension device connected with a distant and conveniently located post. Before attachment to the tension device the wires are passed through apertures in the pinions, and, the machine being moved close to the post at which the work is to be commenced, the toothed segment is moved by its handle, imparting motion to the opposite rack bar and pinions, whereby a twist is given in the wire close to the post. The machine is then moved a slight distance away and a slat or lath passed down between the strands, when the rack bar is moved in the opposite direction, giving a reverse twist to the strands on the outer side of the slat, and holding it firmly in upright position. Slat after slat is thus bound in place, the twists being alternately made in opposite directions until the panel has been completed.

For further information relative to this invention address the Belt & Loether Fence Machine Co., Fredonia, Kansas.

AN IMPROVED TOY PISTOL.

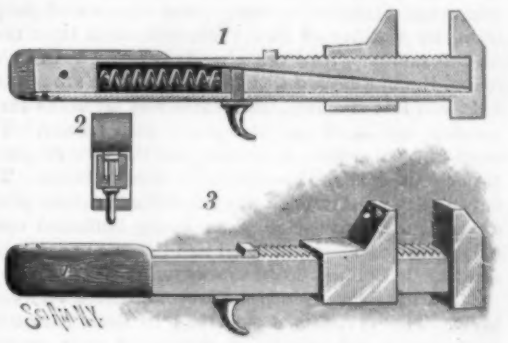
The pistol shown in the illustration is designed to conveniently and rapidly explode paper percussion caps, the construction being also applicable, according to the inventor, with mock guns or rifles suitable for use in political campaigns. The barrel is preferably of tin, and fitted to slide tightly on the forward end of the body, in which are journaled two feed rolls, one bearing a ratchet, while a guide tube in the mouth of the body leads to the intersection of the feed rolls. The hammer has a downwardly projecting arm pivoted in the stock, and a flat spring secured by one end in the rear part of the stock bears with its free end on a stud on this hammer arm to throw the hammer down on the upper face of the pistol body. The trigger is arranged on the same pivot as the hammer arm, and a horizontal pawl is pivoted by one end to the trigger, the forward part of the pawl being in engagement with the ratchet of the lower feed roll, and being supported by a coiled spring in the stock. The barrel being detached from the stock, a strip of fulminate ribbon or paper percussion caps is folded therein, the barrel serving as a magazine, and one end of this strip is drawn from the rear end of the barrel through the guide tube and between the feed rolls, over the hammer bed, between a guide pin and the hammer arm, the hammer being cocked. The barrel is then adjusted on the stock, and, when the trigger is pulled, the spring-pressed stud on the hammer arm is thrown out of alignment with the pivot of the arm, when the spring forces the hammer sharply down upon the cap. When the hammer is cocked for refiring, this spring-pressed stud on the hammer arm is again brought directly under the pivotal point of the hammer, whereby the spring is prevented from acting until the trigger is pulled, while the motion of the trigger causes the fulminate strip to be fed a sufficient distance to locate another cap on the bed for the action of the hammer.

For further information relative to this invention address the patentee, Mr. Charles Blampied, No. 195 Lamartine Street, Jamaica Plain, Mass.

ONE of the companies in Paris that deal in compressed air for motive power has been awarded the contract for street lighting on a novel plan. The company distributes power through its condensed air system to an immense number of small dynamos, each of which furnishes a current for a small number of lamps.

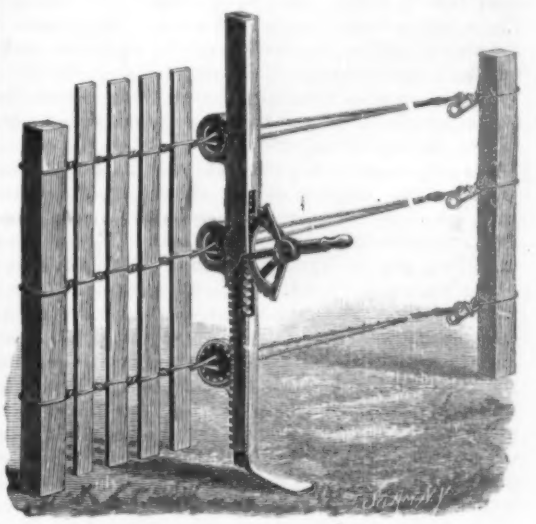
AN IMPROVED WRENCH.

A wrench which is readily applied and easily manipulated to grasp large or small objects has been patented by Mr. Walter S. Bunch, of Marshfield, Oregon, and is shown in the accompanying cut, Fig. 1 repre-



BUNCH'S WRENCH.

senting a longitudinal and Fig. 2 a transverse section thereof, Fig. 3 being a view in perspective. The movable jaw of this wrench has teeth on one of the sides of its bore, adapted to be engaged by similar teeth on top of a wedge fitted loosely in a recess of the handle, and supported at its small end by a spring secured to the rear end of the handle, this spring having a tendency to throw the wedge inward and disengage its teeth from those of the movable jaw. The under side of this wedge is adapted to be engaged by another wedge, a handle or trigger from which projects through a slot in the bottom of the handle, a spring pressing against the larger end of the lower wedge. In normal position, this spring operates to hold the teeth of the upper wedge in engagement with the movable jaw, holding the latter where it has been placed. To adjust this jaw the operator presses the trigger rearward, thus withdrawing the lower wedge,



BANKS & BELT'S FENCE-MAKING MACHINE.

when the upper wedge springs inward, by the force of the spring extending from its small end and its own weight, whereby the movable jaw is unlocked and can be moved to any desired distance from the fixed jaw on the outer end of the wrench. When the pressure on the trigger is removed, the spring acting against the lower wedge causes the movable jaw to be immediately locked in place.

FORMULA FOR INSECT BITES.—One of the very best applications for the bites of mosquitoes and fleas, also for other eruptions attended with intense itchings, is: Menthol in alcohol, one part to ten. This is very cooling and immediately effectual. It is also an excellent lotion for application to the forehead and temples in headache, often at once subduing the same.—*Weekly Med. Review.*

BLAMPIED'S TOY PISTOL.

THE LAUNCH OF THE ARMORED CRUISER MAINE AT THE BROOKLYN NAVY YARD.

On Tuesday, November 18, 1890, the hull of the armored cruiser Maine was successfully launched at the Brooklyn navy yard, in the port of New York. It is the largest vessel ever built at this yard, and its launching attracted a very great number of people from the vicinity of New York, and even from more distant points. We have already described and illustrated the building of the ship (see SCIENTIFIC AMERICAN, vol. lxi., No. 14). The frame was set up as far as possible inside of one of the old ship houses. The length of the cruiser was such that the bow projected many feet beyond the front of the building. The depth of the hull was so great that the flagstaffs which a vessel always carries when being launched could only be set up after the vessel had left the house, while she was still sliding down the ways.

The arrangements for the spectators were very complete. The invitations specified in each case some particular stand. Of these, a number were erected, and designated by letter. Around the bows and on either side of the ram was the "launching platform." Upon this a small staging was erected over the ram for the Secretary of the Navy, the admiral of the yard, Ex-Secretary of the Navy William C. Whitney, and some guests. The breaking of the traditional bottle of champagne and the naming of the ship was entrusted to Miss Alice Tracy Wilmerding, who stood upon this platform. She is the granddaughter of the secretary. The champagne was made from grapes grown in San Benardino County, California.

The operations of preparing for the launch began shortly after eleven o'clock. Two gangs of men on each side, armed with oak rams, about ten feet long, with four to six men to a ram, began to drive in the wooden wedges on each side of the ways. As these are driven they tend to lift the ship bodily from the keel blocks that have sustained its weight hitherto, and from the shores at the sides that have assisted its stability of equilibrium. The wedges were cut of such length as to admit of twenty inches driving. Eight inches was found to be sufficient. This loosened the shores and keel blocks enough to allow the workmen to knock and split them out of place. In about an hour the ship was clear of everything except the forward keel blocks and trip shores, and rested with full weight in the cradle.

The ways consist of upper and lower divisions. Two long, parallel courses of timber forming the lower ways are first laid down on each side of the ship, thickly coated on their upper surfaces with grease, and extending well down into the water. Upon these the upper ways are placed, which correspond in length with the ship. They are bolted down at their upper end to the lower ways. Upon these the cradle rests, and the wedges already spoken of are driven between the cradle and upper ways to bring the vessel's weight upon the latter. To release the hull the upper ways are sawed in two just below the bolts, and then nothing but friction holds the ship. Often a ship will start off of her own accord. In the case of the Maine rams were applied to start her, but they did not act. Meanwhile steel wedges were being driven into the saw cut. The rams were removed, and while the wedges were still being driven, tackles were hooked on each side and a strain put on them. The great mass started imperceptibly into motion. The bottle of champagne was broken, and in less than a minute the hull was floating in the water. The hour of the launch was about 12:45 p. m.

The first keel plate of the Maine was laid Oct. 11, 1888, so that a little over two years have elapsed from commencement to completion of the shell. The hull was designed by Commodore Theodore D. Wilson. The engines were designed by Commodore G. W. Melville, of the Bureau of Engineering. The guns and equipments are to be supplied by the different bureaus of the Navy Department. It ranks as an armored cruiser of the first class. It is built of steel throughout. The dimensions are as follows: Length over all, 324 ft. 4½ in.; on load water line, 318 ft. 3 in.; extreme beam, 57 ft.; mean draught, 21 ft. 6 in. Displacement, 6,682 tons. Speed, estimated, 17 knots. As launched, the displacement was only 1,700 tons on a draught of 7 ft. forward and 7 ft. 6 in. aft.

As at present determined, the ship is to have a protective belt of armor on the sides, 180 ft. long and 12 in. thick. Quite probably it may be made of the new nickel steel, of a type to be accurately determined by further tests. The large guns are to be worked in pairs from two Hichborn turrets, one forward on the starboard side and one aft on the port side. The guns will be protected by 12 in. armor for the turrets or barbettes, with 8 in. shields for the guns. The latter are 10 in. breech-loading rifles, and form the main battery. An auxiliary battery of ten 6 in. rifles is to be mounted on the battery deck, protected by 2 in. shields. The secondary battery is to include four 6 pounder, eight 3 pounder, and two 1 pounder rapid-firing guns, four revolving cannon, and four Gatling guns. There are also seven torpedo tubes covering the entire horizon.

The rig is to be all fore and aft sails on three masts. They are to be provided with armored tops, so as to constitute fighting masts.

The deck is to be of 2 in. steel amidships and of 4 in. thickness on the sloping parts. Cellulose or woodite is to be used where it may be useful in closing up after the passage of a shot. The bottom is double and cellular, with numerous water-tight subdivisions.

The engines are to be of vertical inverted cylinder type, and have three cylinders for triple expansion, of following dimensions: H. P. cylinder 35½ in., I. P. cylinder 57 in., L. P. cylinder 88 in., stroke 36 in. There are two engines actuating twin screws. At 132 revolutions the engine will give about 9,000 indicated H. P. Eight steel boilers 14 ft. 8 in. by 10 ft., to work up to a pressure of 135 lb., are to be used. The propeller will be three bladed and of 15 ft. diameter. The pumps for all purposes are of the well known "Blake" type. They will supply hydraulic power as well as water for the general requirements of the engine. With all bunkers filled there will be 822 tons on board, enough to last for 7,000 knots' steaming.

The engines are to be built by N. F. Palmer, Jr. & Co., of this city. The armor plates are to be rolled at the Bethlehem Steel Works, Bethlehem, Pa. The cost of the entire structure will be about two and one half millions of dollars. It is proposed to put the armor plates on while the ship is in the dry dock. Traveling cranes will have to be installed on each side of the dock for this purpose. The cranes are to be of forty tons capacity, and will cost $50,000 apiece. Two will be for the Brooklyn yard, and two others are proposed for the Norfolk, Va., yard for putting on the plates of the Texas.

The following list of dates in connection with the Maine is of interest as showing how long it takes to execute the work and fulfill the legal requirements in such cases:

Built under act of Congress approved August 3, 1886. Designed by the Navy Department. Plans approved November 1, 1887. Bids for materials opened June 4, 1888. Contract for materials signed June 15, 1888, with Messrs. Carnegie, Phipps & Co., Pittsburg, Pa. First frame bent September 10, 1888. First keel plate laid October 11, 1888. First rivet driven November 2, 1888, 11 o'clock a. m. First frame raised December 5, 1888. Vessel launched November 18, 1890.

Glaciers—their Formation and their March.

In high valleys, among the mountains whose tops are covered with perpetual snow, are often found seas of ice, called "glaciers." They are formed thus: Snow that falls upon lofty mountains melts very little even in summer. So in valleys high up among the mountains it gathers to a great depth, and, from the weight of the snow lying above, the lower layers become icy, as a snowball does when squeezed. The upper crust melts a little during the heat of the day, and the water sinks down through the snow, and then freezes at night. From this melting and freezing the mass of snow is soon changed into a sea of ice.

In traveling down valleys those ancient glaciers left traces of their journey. Over all the places where the ice seas passed, the rocks are rounded and highly polished. A field of these rounded rocks, when seen from a distance, looks like a field filled with sheep crouching on the ground, and Swiss geologists have called them *roches moutonnees*—"sheep-like rocks." In a valley along the summit of the Rocky Mountains, near the "Mountain of the Holy Cross," there is a beautiful display of these polished, rounded rocks.

As the glaciers moved down the valleys, great rocks, frozen fast in the ice on the sides and at the bottom, scratched and marked other rocks as they passed by and over them. Sometimes these scorings are very broad and deep, for the immense rocks the glaciers carried were like strong, powerful tools in the grasp of a mighty engine. Sometimes the lines are as fine as those of a fine engraving. They usually run all one way, and, by looking at the direction in which the lines run, one can tell the direction in which the glacier moved. In the sandstone west of New Haven, Connecticut, the deep, broad scorings can be plainly seen, running toward the southeast. The height at which these scratches occur tells us something of the depth of the ice. Markings in the White Mountains indicate that the ice was more than a mile deep over the region now known as northern New England.

Wherever the glaciers melted, they left an immense amount of "drift," that is, sand, gravel, and stones of all sorts, which had been frozen in the ice when the glaciers were forming. The stones of this drift are of all sizes. Some are as small as pebbles, others as large as small houses. There is one at Bradford, Massachusetts, which measures thirty feet each way, and weighs four and a half million pounds. There is another on a ledge in Vermont which is even larger than that, and which must have been carried by the ice across a valley lying five hundred feet below where the stone now is, showing that the ice was five hundred feet thick. Great bowlders of trap rock extend through Connecticut on a line running to Long Island Sound; and, as some of the same kind are found in Long Island, the glacier is believed to have crossed the Sound, carrying these rocks with it. An immense statue of Peter the Great, in St. Petersburg, stands on one of these glacier bowlders of solid granite, which weighs three million pounds. One of the largest bowlders in America is in the Indian village of Mohegan, near Montville, Connecticut. The Indians call the rock "Shehegan." Its top, which is flat and as large as the floor of a good sized room, is reached by a ladder.

Sometimes these bowlders are found perched upon bare ledges of rock, so nicely balanced that, though of great weight, they may be rocked by the hand. They are called "rocking stones." Near the little Connecticut village of Noank, on Long Island Sound, there is an immense bowlder called by the people there "Jemimy's Pulpit." It was formerly a rocking stone, but the rock has worn away below it and it can no longer be moved.—*Teresa C. Crofton, in St. Nicholas.*

PHOTOGRAPHIC NOTES.

Cheap Developing Trays.—That very useful waterproof material, Willesden paper, forms by far the best material for developing trays. The trays are made by cutting out a square 2½ inches larger each way than the required size of plate, and folding up the sides in the way children make a paper box. The corners are secured by a few stitches along the edge, the finished tray presenting the appearance as below. Now paint with a brush dipped in vermilion in very large, bold letters, in the middle of the bottom in the inside, a word indicating its future use, such as pyro, oxalate, toning, hypo, etc. Next melt in a beaker or an old jam tin some solid paraffine, about 125° melting point; a paraffine candle will do, or, if paraffine cannot be procured, use an ozokerite candle, or even the stearine of a common or domestic composite. Heat this up so that the temperature of the fluid is well above the melting point—nearly boiling, in fact. Place your paper tray on a piece of window glass, and pour into it the whole of the contents of the beaker. Tilt the glass quickly to all four sides, so as to wet the sides up to the edge, and then pour back into the beaker, doing all as smartly as you can. When in use, the trays are held on a slip of window glass an inch larger each way than the size in use. They have many advantages over any other form of tray, of which the following are the most important:

First.—They require no cleaning, as, when emptied, the water runs off them as it does off a duck's back, so that they become quite dry instantly. As the fluids never adhere, pollution of one solution by another becomes impossible, even if the same tray be used for several purposes.

Secondly.—The weight of the contained fluid presses them down on to the piece of glass on which they are held, so as to obtain a perfectly flat surface, so that less solution is required than with any other tray. It is easy to develop a whole-plate film with six drachms of solution.

Thirdly.—Besides being very cheap, they are so portable that half a gross would scarcely weigh as much as a single porcelain tray. For camp work nothing is so suitable as half a dozen of these trays, carefully made so as to "nest," and packed in a japanned tin case open along one side, so as to form a deep, narrow tank, and provided with a tin or brass spout near the bottom, on to which is slipped half a yard of rubber tubing fitted with a pinch cock. The outer case then serves as a water tank when developing.—*F. M. Giles, M.B., F.R.C.S., Jour. of the Photo. Soc. of India.*

The Latest New Atlantic Steamship.

The new North German Lloyd steamship Spree, which arrived at New York October 21, from Bremen, was built by the Vulcan Shipbuilding Company, in Stettin, Germany. She is 485 feet long by 53 feet beam and 38 feet deep. She is 9,000 tons burden, is built of steel, and is divided into fifteen watertight compartments by fourteen bulkheads. These are really valuable, for they are kept permanently closed. The Spree is propelled by a single screw, operated by triple-expansion engines of five cylinders, with three cranks. The engines develop 13,000 horse power, and give the steamer a speed of 21 knots an hour. The diameter of the screw is 22½ feet. Steam is generated in 10 steel boilers, 6 double ended, 4 single ended, and having in all 48 stoke holes. The diameter of each crankshaft is 24½ inches, the 3 crankshafts having a weight of 75 tons. Four dynamos furnish power for the illumination of the steamer. Each dynamo has a capacity of 350 incandescent lamps, each of 25 candle power. The Spree has accommodations for 200 passengers in the first cabin, 125 in the second, and 460 in the steerage.

As a means of preventing the formation of bubbles in albumen paper, Herr Kronke recommends the following solution:

Glycerine	15-20 c. c.
Water	100 "
Common salt	5 grammes.

The prints are immersed in this solution immediately on being taken off the frame. The object of the salt is to precipitate any silver dissolving in the bath as chloride. The efficacy of Herr Kronke's receipt does not seem to be very well established, however.

Patent Legislation for a Century.

The present century has been the time, and the United States the place, in which invention has made its greatest strides. The current year has witnessed the centenary of the United States patent system. It seems, therefore, a fitting time to review the history of the country's patent system, and to contrast the condition of invention at the beginning and at the close of the century respectively. An interesting paper covering this ground appears in the current number of the *Quarterly Journal of Economics*. The author, Mr. Chauncey Smith, displays familiarity with his subject, and the paper bears the marks of research.

It has been said that the current year is the centenary of the patent system of the United States. The beginning of the patent legislation of the United States was an act passed on April 10, 1790, under the power given to Congress in the Constitution, "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." This act, which was entitled "an act to promote the progress of useful arts," provided that patents might be granted for the invention or discovery of any useful art, manufacture, engine, machine or device, or any improvement thereon, not before known. This provision has not been much changed in the interval, the language of the existing statute extending to any new and useful art, machine, manufacture or composition of matter, or improvement thereof. Applications for patents were to be made to the Secretary of State, the Secretary of War, and the Attorney General. The right secured by a patent was "the sole and exclusive right and liberty of making, constructing, using, and vending to others to be used" the invention or discovery for the period of fourteen years. A description of the invention in writing and a model of the same where the case admitted of it were required. The patent was made prima facie evidence that the patentee was the first inventor, and that the invention was truly described. This provision marked a change from the English system, and has been retained ever since. The act contained no limitation of its benefits to citizens of the United States, but granted its privileges to "any person."

Another act was passed in 1793. This act limited the benefits of the law to citizens of the United States. Applicants were required to make oath that they believed themselves the true inventors. The administration of the law was committed to the Secretary of State and the Attorney General. In 1800 the right to take out patents was extended to aliens who had resided for more than two years within the United States, and the right was also extended to the legal representatives of an inventor who had died before a patent was issued to him. In 1819 an important step was taken by giving the circuit courts of the United States jurisdiction of actions for the infringement of patents, with power to grant injunctions. In 1832 the practice already established was recognized of reissuing patents to correct mistakes.

In 1836 the previous acts dealing with the subject of patents were repealed, and a new and comprehensive act was passed. This act created the Patent Office and attached it to the Department of State. It has since been attached to the Department of the Interior. The office was placed under the charge of a commissioner, who was to superintend and perform all duties connected with the granting of patents. Foreigners were placed by this act on the same footing as citizens, except as to the amount of the fees to be paid. The conditions entitling to a grant were the same, substantially, as under the act of 1793. Provision was made for an extension of the original term of fourteen years for seven years additional in case it should appear that the patentee had, without neglect or default on his part, failed to obtain a reasonable remuneration for his time, ingenuity, and expenses. The authority to grant extensions was at first vested in the Secretary of State, the Commissioner of Patents, and the Solicitor of the Treasury, but in 1848 the authority was vested in the commissioner alone. Applications for extensions became very common, and at length so much opposition to this feature of the law was developed that in 1861 the law was changed. Patents were thereafter to be granted for the term of seventeen years, and all extensions were prohibited. Another feature of the act of 1836 provided for the registration in the Patent Office of assignments of patents, and of grants of exclusive rights to an invention in specified territories. But perhaps the most valuable feature of the act of 1836 was the power given the commissioner to decide whether an applicant was entitled to a patent under the provisions of the statute. The commissioner, in the discharge of this duty, was obliged to make examination to determine that the invention had not before been made in this country, that it had not been anywhere patented or described in a printed publication, that it had not been in public use or on sale with the applicant's consent or allowance prior to the application, and that it was sufficiently important and useful. Such an examination had not before been required, either here or abroad, but it has since been retained here and has been adopted in other countries. To provide for facilities for examinations the act appropriated $1,500 for the establishment of a library of scientific books, which has since grown to 54,000 volumes. The act of 1836 gave the Patent Office the power to investigate and decide claims of priority between several inventors. In 1837 patentees who had made too broad a claim, and whose patents would have been void under the previous law, were allowed to file disclaimers of portions of the original claim, and their patents were made good for all they were entitled to claim, even though no disclaimer had been made, unless they unreasonably failed to make proper disclaimers. These provisions added to the security and value of patent property.

In 1839 an act was passed which provided that no use of an invention by the public, either with or without the consent of the inventor, should impair his right to a patent unless the use had been for more than two years, or upon proof of abandonment. This gave the inventor the privilege to permit the use of his invention or sell the right to use it without losing the right to the patent where the use or sale was not for more than two years, but, on the other hand, where this time was exceeded, the inventor lost his patent even where the use or sale had been without his knowledge or consent. This legislation may be said to have determined the character of the American patent law. With the exception of the amendment already referred to as having been made in 1861, extending the time from fourteen to seventeen years, no important changes have been made since, though the law had a general revision in 1870 and in 1875.

The growth of the patent system in the century which has elapsed since the first patent law was passed in 1790 has been enormous. Only three patents were granted the first year, and only fifty-five were granted under it before its repeal in 1793. The whole number of patents granted before 1800 was 356, a little more than one-half the number now issued weekly. The number issued in the last ten years, from 1880 to 1890, was 195,454, or more than 800 times the number issued during the first ten years of the patent law. During the forty-six years prior to the passage of the act of 1836 the number of patents granted, exclusive of reissues, was 9,957, a number now exceeded in a period of six months. The number of patents issued by the office in 1836, after the date of the act establishing it, was 109, and the number for the full year 1837 was 436. The whole number of patents issued in 1889 was 24,083. In 1836 eight persons made up the force of the office, and the aggregate of their salaries was $11,550. The expenses of the office for the first full year were $33,506.98, and the receipts $29,289.08. In 1889 there were more than 560 persons employed in the office. The receipts amounted to $1,281,728.05, and the expenses to $1,052,955.98, leaving a net surplus of $228,772.07. The whole number of patents granted since 1836 was 431,541. According to Mr. Smith's calculation, in fifty-four years the number of patents increased more than fifty-five fold, the receipts more than forty fold, the expenses more than thirty-two fold, and the number of persons employed seventy fold. The increase has been truly wonderful. It speaks volumes for the growth of invention and the application of science to industry in the last century, and more particularly in the last half century.

In addition to recounting the history of the patent system in the United States, the writer discusses the question as to the utility of the system. One would suppose that a mere statement of the results achieved under it would afford a sufficient answer to this question. But it is known that hostility to the patent system crops up frequently, and that bills are constantly presented in Congress providing for the repeal or modification of particular features of the act. Indeed, Mr. Smith mentions the fact that he was assured some years ago by a member of Congress from Massachusetts that a large number of the members of the House of Representatives were ready at any moment to vote for the repeal of the law as a whole. By some the objection is made that a patent law does not stimulate inventions, but that inventors are impelled by a spirit of invention which they cannot themselves resist. In answer to this the writer, while recognizing that the greatest inventions and discoveries have been actuated by motives independent of the hope of pecuniary reward, yet points out that the great number of people who take out patents in the United States are stimulated by the hope of gain, and act in every way as if they were. This really goes without saying, as far as inventors themselves are concerned, and it is even more true as regards capitalists, who nowadays, as Mr. Smith points out, are almost as necessary to the introduction of inventions as inventors themselves. The capitalists as such certainly have not any motive to interest themselves in new inventions but the hope of gain which the patent laws afford a chance of securing. The evidence of accomplished facts is certainly all in favor of the doctrine that patents do stimulate invention, for, as the writer points out, the three countries which in this age of invention have contributed the greatest number of radically new and highly valuable inventions are the three countries which have longest secured to inventors a right to their inventions, viz., England, the United States, and France.—*Bradstreet's.*

The Coke Industry.

The manufacture of coke is an industry of considerable importance, as an indispensable factor in our production of iron and steel. The proximity of its access to our metallurgical centers enters largely into the cost of production, and its qualities are more or less a premium or a discount on the value of the manufactured metal.

It is obtainable from all the five great coal fields of the United States—the Appalachian, Central, Western, Rocky Mountain, and Pacific. It varies considerably in quality and value and physical characteristics. In the Connellsville region, which is the great coke-producing district of the United States, the coal bed is in the form of a basin, some three miles wide and fifty miles long, yielding eight to ten feet of workable coal, with only one small slate parting eighteen inches above the floor. It is soft and easily mined, the digging being easy, one man and a boy having dug and loaded 57,684 pounds inside of ten hours. This ease of mining is the distinguishing feature of the Connellsville basin. East or west the cost of mining increases; westward the coal hardens, and eastward the beds become thinner.

The Rocky Mountain field ranks next to the Appalachian in importance, both immediate and prospective. It includes the coal beds of Dakota, Montana, Idaho, Utah, Wyoming, New Mexico, and Colorado, the latter ranking fifth as a coke-producing State. Its proximity to the mines of the precious metals and the smelting works of extensive districts are evidence of its importance, even if of inferior quality. In the two Virginias, Tennessee, and Alabama the same reasons hold good for its value and importance. Two new fields of coking coal, low in sulphur and ash and high in fixed carbon, and equal to the best Pocahontas as metallurgical fuel, have been found in the vicinity of Big Stone Gap, Va., and Middlesborough, Ky., and add to the industrial prospects of these new centers of metallurgical production.

There is practically no exhaustion of the sources of coke supply. It is correlative with our mineral deposits, and if graded in quality and proximity of access, is yet in sufficient quantities to assure all the necessary supply. In the present production of coke Pennsylvania outranks all the other States, producing in 1888 some 6,545,779 tons; West Virginia next, producing 581,762 tons; Alabama comes third, with 508,511 tons; and Tennessee fourth, with a production of 385,693 tons. The number of ovens increased from 12,372 in 1880 to 30,069 in 1888, and the total product in the same time from 3,338,300 tons to 8,540,030 tons, the values in 1880 representing $6,631,267, and in 1888, $12,445,963. The cost of coke varies, and its commercial oscillation is largely in touch with its accessibility. The coke made in Wisconsin in 1888 was from coal produced in Pennsylvania, and some made in Ohio and Kentucky from West Virginia and Pennsylvania coal. Its value in Pennsylvania was $1.20 per ton; in Colorado, $4; in New Mexico, $6; in Montana, $8.

The following table gives some interesting figures on the coke manufacture in the United States from 1880 to 1888, inclusive:

Years.	Tons—Coal used.	Tons—Coke made.	Values.
1880	5,237,714	3,338,300	$6,631,267
1881	6,540,602	4,113,790	7,795,175
1882	7,577,648	4,793,321	8,462,167
1883	8,516,670	5,014,721	8,121,607
1884	7,961,974	4,873,805	7,242,878
1885	8,071,123	5,106,606	7,629,118
1886	10,668,972	6,845,309	11,153,306
1887	11,859,753	7,611,705	15,321,116
1888	12,945,350	8,540,030	12,445,963

In the nine years included in this table the increase in product has been 156 per cent, while in the average selling price the value in 1888 was the lowest in the time specified. The related position of coke to our iron and steel industries places the manufactured cinder among the most important contributions to our industrial prosperity, and it must of necessity coextend with all our metallurgical enterprises.—*Age of Steel.*

Diving Apparatus Improvement.

Some practical improvements in diving apparatus have been effected by M. Albert Marcelhacy, a French engineer. Instead of the heavy electric hand lamp hitherto used by divers, he affixes a light but powerful glow lamp on the top of the helmet, so that the diver's hands are both at all times free for work. The lamp is connected by a conductor with a battery either on shore or in a vessel above, as the case may be. The next point is a new method of connecting the helmet with the dress, without any loose parts, and this is effected by means of only one water-tight joint instead of two as in the ordinary dress. In the new method the upper part or collar of the India rubber dress is gripped in between the lower rim of the helmet and the upper rim of the breastplate, and there held fast by gripping pieces attached to the breastplate. These improvements have been adopted in the French navy.

THE ELECTRIC UNDERGROUND RAILWAY, LONDON.

Among the new works lately inaugurated in London is an underground electric railway known as the City and South London Railway, 3¼ miles in length. It was opened on November 4, 1890, by the Prince of Wales, and the public interest in it has been excited by reason of the novelty of the location, the method of working and the method of construction. The roadbed consists of two tracks 4 feet 8½ inches in width, which are laid in two underground tunnels, each 10½ feet diameter. These at present extend from King William Street, near the Monument, thence under the Thames River to the south side of the river, thence along and under High Street, Newington Causeway, Kennington Park Road and Clapham Road. There are four stations. One of the peculiarities of the work is its great depth underground, the rails being, with few exceptions, not less than 40 feet below the streets, while in some places they are 100 feet underground. At the stations the two tunnels are brought into an enlarged chamber built underground, and from these passengers are raised by elevators to the street level. The cars are propelled by electric locomotives, of which fourteen have been supplied.

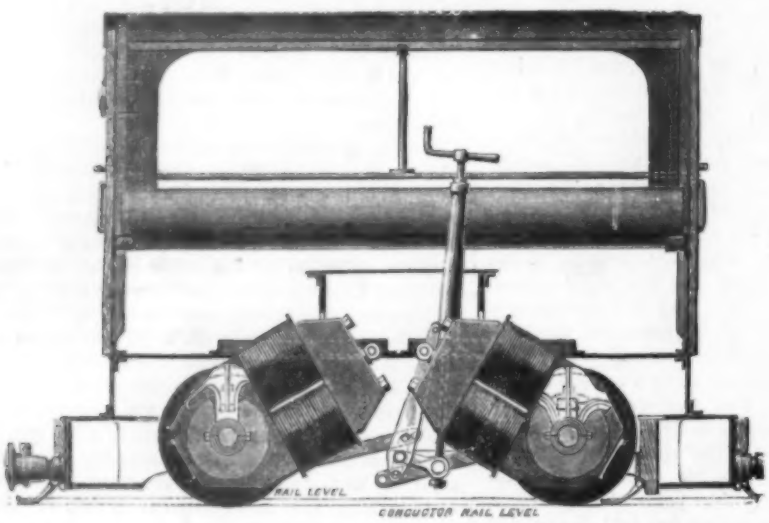
When the promoters were before Parliament for the purpose of obtaining authority to build the tunnels, they met with much opposition from property owners along the line, and a searching inquiry was made into the particulars of the mode of building and the intended working of the line. The company produced witnesses to prove that the tunnels were to be constructed by means of hydraulic shields similar to that used in America in making the short section of Broadway tunnel. The cars were to be worked by cables, same as in America at San Francisco, Chicago, and New York. The cars were to have end platforms and protecting gates, and Westinghouse brakes, same as in America. The passengers are to pay on entrance and be raised and lowered from the underground tunnels by means of elevators, same as in America, and so on. Many curious questions calling for explanations of these novelties were put to the witnesses by the parliamentary examiners, for most of the features were new to them. But the fact of successful operation in America carried the day, and the necessary authority to build was granted.

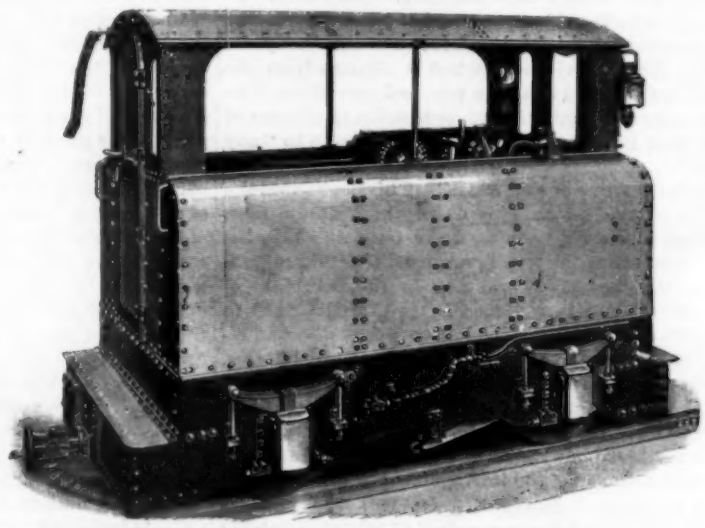
During the construction of the tunnels a few difficult places were encountered where the water came into the headings; but these troubles were readily overcome by using another American device—Haskins' system of compressed air. This was supplemented by an ingenious device of Mr. Greathead, the engineer, which consisted in playing a spray of grouting upon the exposed portion of the porous heading of soil. The compressed air acted to force the grouting into the soil, and thus stop the outward leakage of air and prevent entrance of water.

The rapid improvements in electric economies enabled the projectors to substitute electricity as a motive power in place of the cables as first planned. The cars, lighted by electricity, are 29 ft. in length over the platforms. The trains consist of an electric locomotive and three cars, accommodating in all 100 passengers to the train, which weighs all told 30 to 40 tons. The locomotives are able to make 25 miles an hour, but the time for the trip of 3¼ miles, making four stops, is at the rate of 15 miles an hour.

The underground stations are from 20 to 28 feet in diameter. From them stairs lead to waiting rooms at the street level; also elevators. There are two elevators for each station, which will carry up a train load, namely, 100 people, in 30 seconds.

The electric locomotives weigh 10 tons each. On each axle is the armature, which forms the spindle of the motor. The axles are independent. There is no gearing of any kind. Each locomotive is of 100 horse power. The current is picked up from a center rail, carried on glass insulators. The track rails serve as return conductors. The dynamos are of the Edison-Hopkinson type, and to drive them three Fowler engines, each of 375 horse power, are provided. The operation of the cars, elevators, etc., is reported as being very satisfactory; but the reverberating noise of the train when running through the tunnel is spoken of as rather disagreeable. We give from the *Illustrated London News*, *The Engineer*, *Engineering*, and the *Daily Graphic*, several illustrations, embracing a map of the route, river diagram, the appearance of the tunnels, the stations, the electric locomotives, etc.





ELECTRIC LOCOMOTIVE—LONDON ELECTRIC UNDERGROUND RAILWAY.

The Hudson River Tunnel.

To the Editor of the Scientific American:

My attention was drawn to your issue of November 1, in which you explain the operations now proceeding under the Hudson River by the Hudson River Tunnel Company.

The information which you have received is both partial and misleading. Mr. J. H. Greathead is the inventor and patentee of the system of tunneling adopted by the Hudson River Tunnel Company, and the peculiar machinery now used by that company was devised by him, and the work of construction carried on under his supervision. On behalf of Mr. Greathead, I have made a contract with the Hudson River Tunnel Company, under which they are permitted to use the patent device of this great engineer, and he, together with Sir John Fowler and Sir Benjamin Baker, made the drawings under which the Hudson River tunnel is now being constructed. I desire you to make the necessary correction of your report, because great injustice is done to Mr. Greathead in his position as engineer and to the value of his patents in the United States by your statement, which, if promptly corrected, I assume to have been inadvertently made, and therefore, if so corrected, although the damage cannot wholly be repaired, it will relieve you from any responsibility in regard to the matter.

I am Mr. Greathead's agent and attorney in the United States, interested in his inventions, and the tunnel, as now being carried on under the Hudson River is practically in imitation of the great Southwark tunnel and subway which Mr. Greathead constructed. If you will take your file of the English *Engineering*, and turn to page 306 of the issue of March 7, 1890, you will find a statement of the completion of that line of subway in London. I have boxes full of evidence, patents, and other documents in support of these facts, and the tunnel company itself, whose work you illustrate in your paper of November 1, admits by contract and payments of royalty therein provided for that the invention which makes their work practicable is that of Mr. Greathead. The St. Clair tunnel was built upon the drawings made by Mr. Greathead, which were improperly appropriated by the Grand Trunk Railway Company, and I am under instructions to proceed against that company for the unauthorized appropriation of Mr. Greathead's ideas and infringement of his patents.

Respectfully,

SIMON STERNE.

New York, November 12, 1890.

[We stated in our paper of Nov. 1 that the Hudson River tunnel was being constructed by means of the hydraulic shield and the use of compressed air in the heading. The impression conveyed by our correspondent's letter is that both of these important inventions originated with his client, and that he now holds the patents upon them. In this our correspondent is mistaken. Mr. Greathead, we think, has never claimed to be either the originator or the patentee of them, those boxes of evidence and other documents to the contrary notwithstanding.

With the inner secrets of the tunnel company we do not pretend to be acquainted. No doubt they are using a variety of indispensable patents, for about every tool and appliance that can be thought of nowadays is patented.

Mr. J. H. Greathead was the engineer of the two 10½ ft. tunnels lately completed in London, of which we give description in these pages. His experience in tunnel building has been extensive. In this line he is the author of several effective and ingenious devices, which are patented. The Hudson River Tunnel Company is to be congratulated on having the benefit of the ideas, devices, and assistance of an engineer so able and competent. It is an added assurance that this great and difficult work is to be prosecuted with the highest skill.

In our recent article we credited the first use of compressed air in horizontal tunnels to Mr. Haskin, and the first construction of the hydraulic shield to Mr. Beach. Compressed air had been used in sinking caissons long prior to Mr. Haskin's time. Still, we believe he is justly entitled to the credit of the idea of using it as a support of the earth in tunnel headings, and but for him probably there would, to-day, be no Hudson River tunnel. Sundry proposals for tunneling shields, and hydraulics with them, date back nearly to the beginning of this century. But we think it will be found the first hydraulic shield actually built and put into use, and carrying a connected series of hydraulic rams for propelling and at same time directing the shield, was that of Mr. Beach, with which in 1869 he built the section of railway tunnel under Broadway, New York. This tunnel was 9 ft. 4 in. in diameter. The London tunnels recently completed by Mr. Greathead were built with shields of the above description. They are 10 and 10½ feet interior diameter.

The gigantic shields used by the Grand Trunk Railway under the St. Clair River were of the above character; so is the great shield now at work in the Hudson River tunnel.—ED. S. A.]

Has Pure Water any Color?

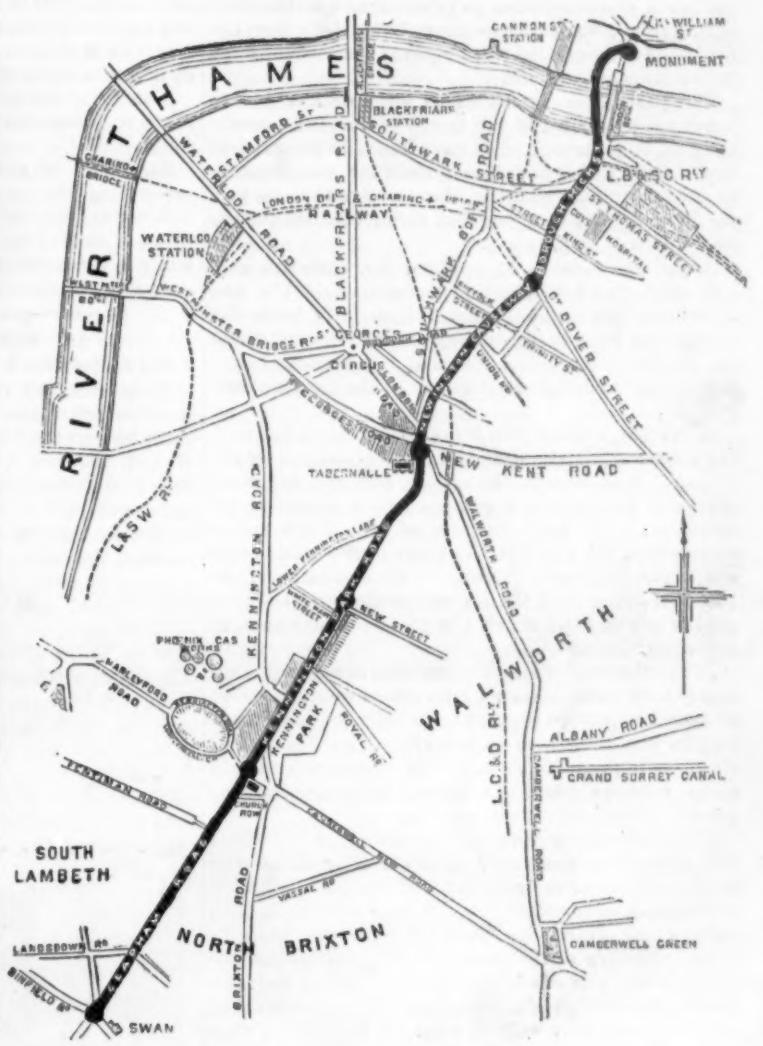
Dr. McPherson, writing to a local scientific journal (*Pacific Record*), states that it has now been undeniably proved that distilled water has a blue color. A Scotch gentleman of much perseverance has carried out a series of experiments, and proved this fact, which he says is easily demonstrated as follows: Let down into water a metal tube (open at the top and closed with a clear glass plate at the bottom) close to a white object 20 feet below the surface. This object when looked at through the tube has a most beautiful blue color. The object would have appeared to be yellow if its color was due to light reflected by extremely small particles of matter suspended in the water.

The Secret of Cheap Building.

A man who is resolved to be independent of landlords can build a very comfortable house for from $2,000 to $2,500. He can have sufficient room, and a house with a decent exterior and a plain interior. He ought, first and foremost, provide a bathroom, even if he cannot buy a slate mantel. It will be wisest in the long run to have a bathroom. Ask any woman who has had the care of two or three children how much a bathroom saves them. The larger the family, the greater the saving in work and worry—which is more wearing than work. If a man has only $2,000 and a large family, he must sacrifice something, or deny himself something, when he builds. If he is wise, he will contrive closets and cupboards, a style of house that renders running up and down stairs unnecessary (there is nothing so tiresome as going up and down stairs), make his dining room large enough for a living room, and see that the arrangement of the kitchen is labor-saving. Slate roof, slate mantels, bay windows, and pretty trimmings can all be dispensed with. There are people who do not seem to have any clear idea of the things

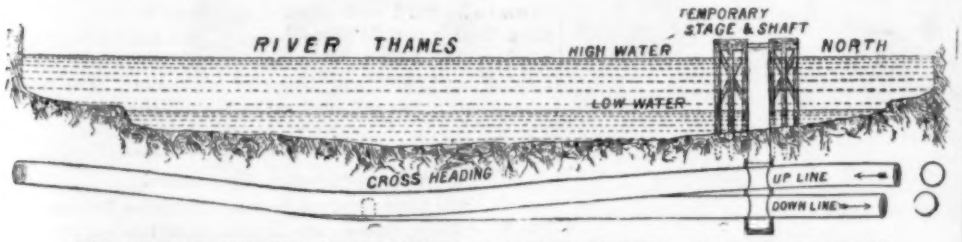
1. Interior of a passenger car. 2. Device for taking the electric current from conductor. 3. Interior of underground station.

THE LONDON ELECTRIC UNDERGROUND RAILWAY.



MAP OF THE LONDON ELECTRIC UNDERGROUND RAILWAY

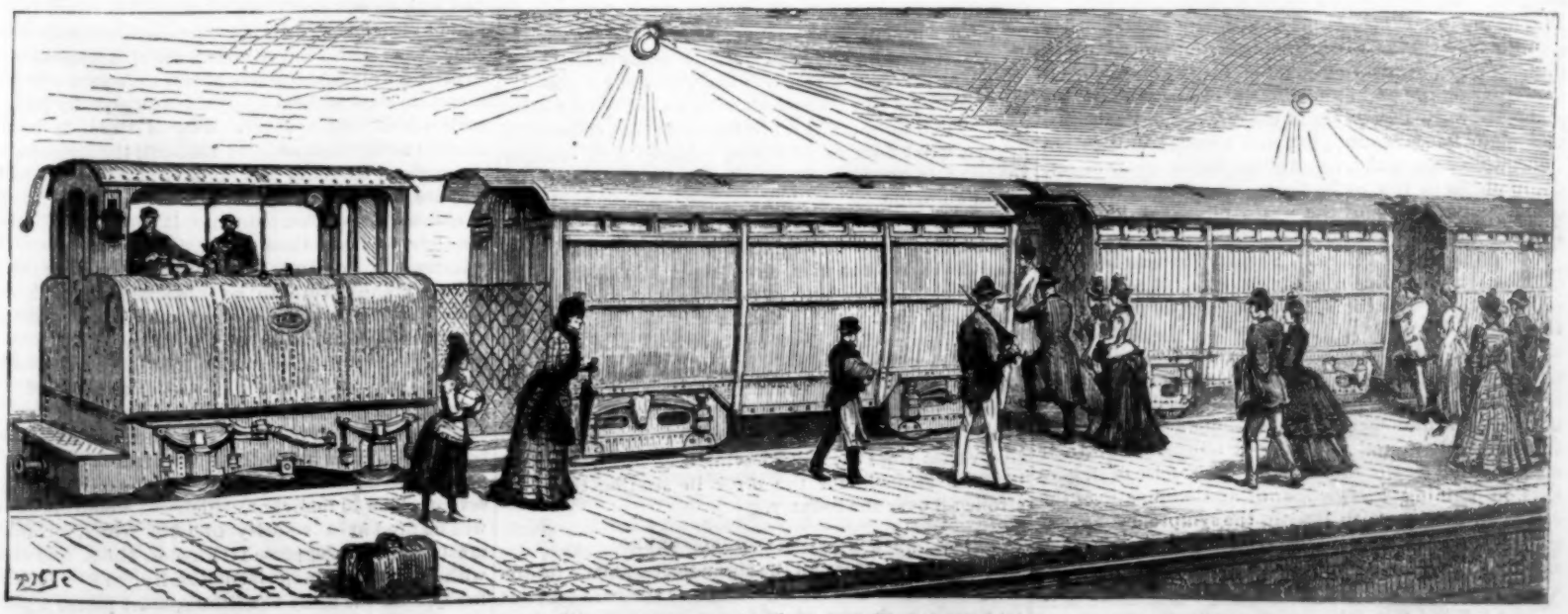
that are appropriate in a cheap house. We recall an instance where a gentleman, after looking at a design for a cheap house, expressed surprise at the cost, which was very low, and in the same breath he inquired if it was roofed with slate. A cheap house is not roofed with slate, it is needless to add. His next query had reference to the plumbing. If his ideas were realized, the plumber would charge at least $300. Evidently the gentleman



THE LONDON ELECTRIC UNDERGROUND RAILWAY—POSITION OF TUNNELS UNDER THE THAMES RIVER.

thought that the plumbing would cost about a third of that sum, or less. To sum it all up, have substantial fixtures rather than pretty trimming. Good ventilation, ample room, plenty of light and warmth may be obtained, if a man desires to insure it in building for his own use, at a very moderate outlay. But then he must, as the *Manufacturer and Builder* says, build to please himself, instead of vying with his neighbors.

THE LONDON ELECTRIC UNDERGROUND RAILWAY—STATION IN THE BOROUGH.



STATION IN THE LONDON ELECTRIC UNDERGROUND RAILWAY—THE ELECTRIC LOCOMOTIVE AND PASSENGER CARS.

Sewer Gas Poisoning.*

Sewer gas is a technical term suggested by one of its sources only. It is a compound product of the putrefaction of excrementitious or other organic matter emanating from a variety of sources, but chiefly from the neglected and unsealed wastepipes in houses connected with sewers or cesspools.

The prevalence of affections more or less due to sewer gas poisoning, at this season of the year, particularly among persons who have recently returned to their homes, which have been unused for some weeks or months during the summer, should serve to make people generally better acquainted with its nature and the indications of its presence.

Sewer gas consists of common air, carbonic acid gas, sulphureted hydrogen, ammonium sulphide, and sometimes free ammonia, and it frequently bears disease germs from filthy wastepipes and sewers, which are the favorite breeding places of such germs. Yet it is commonly odorless even when it is the most dangerous.

Sewer gas ordinarily finds the easiest access to dwelling houses when the occupants are absent, or by the "spare" rooms—those which are, perhaps, the most efficiently and elegantly equipped with plumbing fixtures, but rarely used—because at such times and in such rooms, the water in the traps of the waste pipes evaporates and opens the way for the emanations from the putrefying filth in the wastepipes and the cesspool or sewer, with which the pipes communicate, to enter the apartment.

The indications of the presence of sewer gas are commonly first made known by its effects on the comfort or health of persons exposed to it. Hence these effects may be justly regarded as the symptoms of poisoning by it, though unfortunately, by ignorance or negligence, they are not often taken advantage of as suggestive indications of their cause.

The symptoms of sewer gas poisoning, or the effects of sewer gas as commonly recognized by those who limit the scope of their inquiries to the sick chamber—the diseases more or less due to it—greatly vary in both variety and severity, proportional with the intensity of the exposure or the power of constitutional resistance on the part of the exposed, and hence, unfortunately, the relation of the effects to the cause are much less frequently recognized, even by physicians, than they should be. Named in the order of their relative frequency, approximately, they are about as follows:

General lassitude, unrefreshing sleep, uncomfortable heavy-headedness, morning headache, sticky saliva, bad taste in the mouth, poor appetite for breakfast, nausea on first rising, feebleness, pasty-furred tongue, "malaria," relaxed throat, elongated uvula, ulcerated tonsils, laryngitis, sticky and inflamed eyes, feverishness, disturbed sleep, "nervousness," dyspepsia, irregular action of the bowels and kidneys, diarrhœa, typhoid fever, diphtheria, erysipelas, puerperal fever, pyæmia, septicæmia and death—the post-mortem sign—and this, if attributed to one of the infectious symptoms named (in communities where deaths from infectious diseases are required to be reported), is the only symptom recognized as being of sufficient importance to base inquiry upon. But death much more frequently occurs as the result of the non-infectious diseases due to sewer gas poisoning than of the infectious, though the relations of the former to sewer gas are rarely or never inquired into, either by the physician in attendance or the health authorities.

In cases of death, exclusively reported from infectious diseases, through the medium of sewer gas, the post-mortem examination (of the premises) is commonly conducted by the sanitary inspector of the board of health, whose services in this direction are never otherwise called for, and the signs or symptoms in the premises revealed by his examination are apparently the only ones which medical practitioners generally accept and boards of health appreciate. The symptoms in these cases are about as follows: Corpse, undertaker's paraphernalia, faint or qualmish odor on first entering the premises, chokage or absence of traps under the wash basins, water closets, sinks, washtubs, and main house drain pipe, and absence of ventilation appliances, malodorous cellar, cellar water closet, damp places in the walls, floors, or pavements, along or near the course of the waste pipes, subsidence of floors, rat holes in or about the basement floor.

When the boards of health acquire such knowledge of, interest, and pride in their service as to reverse the order of their work, by such an application of the duties of sanitary inspectors as will gain knowledge of and deal with the preventable causes of disease in anticipation of the issue, if allowed to proceed, instead of continuously waiting for and dealing with the fatal results, and medical practitioners have learned that the highest and most sacred obligation of their office, as well as the most successful exercise of it, consists in gaining knowledge of and eliminating the causes in conflict with health, the symptoms of sewer gas poisoning and the material causes which give rise to it will rapidly wane and ultimately cease to exist.

*A. N. Bell, M.D., in the *Sanitarian* for October, 1890.

A Drinking Fountain for Chicago.

Mr. John B. Drake, proprietor of the Grand Pacific Hotel and one of Chicago's most prominent millionaire citizens, is about to have erected and present to that city an elegant drinking fountain to cost $15,000.

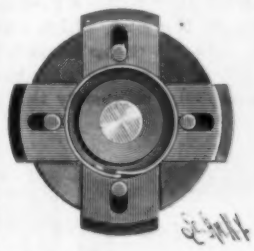
It is to be of polished granite 30 feet high surmounted by a bronze figure of Columbus of more than life size.

A vault for the storage of ice is to be built underneath the fountain, through which the water will be conducted.

Mr. Drake is not actuated solely by a desire to present the city with an ornamental fountain, but he believes it will be of humane service during the crowded state of the world's fair in providing free ice water to the multitude, and thus the cause of temperance may be promoted.

AN IMPROVED FLUE CLEANER.

The device shown in the illustration has a series of radially arranged spring-pressed cutters, forming an effective flue cleaner, which is readily applied and not liable to get out of order. It has been patented by Mr. Wm. H. Watson, P. M. S. S. Co., Isla de Naos, Panama Bay, U. S. Colombia. The casing is made in two parts, each having a hub, and both mounted on a stem forming the outer end of a handle by which the tool is manipulated, the casing being held in place on the stem by a nut on its outer end. Each section of the casing has a cylindrical disk on its largest end, where the two sections meet, and in these disks are formed radial slots in which slide cutters, each having a V-shaped segmental cutting edge. As shown in the sectional view, each of the cutters has a radially extending slot, through which passes a pin on the face of the disk to hold the cutter in place, while allowing for sufficient inward and outward movement. The inner edge of each cutter is also segmental, and rests on a spring held in a circular recess formed in the two disks, the radial slots of the disks leading into this recess. A loose collar is held on the stem in this recess, inside of the circular spring, to limit the inward movement of the spring when it is compressed In introducing the tool, the cutters are pressed slightly inward on one side or the other until the implement is completely inserted,



WATSON'S FLUE CLEANER.

when, by shoving the casing forward and backward, the cutters remove the scale and other deposits adhering to the inside of the tube or flue.

Reckoning Time.

A correspondent of the *Evening Telegram* tells its readers how time is reckoned at the observatory in Washington, as follows:

The observatory does not reckon its time by the sun, but by the so-called "fixed" stars, which are so far off that their position with relation to the earth does not change appreciably within a few months or years. Star time is the only true time, therefore. The operator looks through a big telescope and watches for a given star that he knows to cross the plane of the meridian. As it crosses he records what moment it does so, as shown by a star time clock with a twenty-four hour dial. Then he consults a printed table that shows him at just what number of hours, minutes and seconds the star in question must actually have crossed the meridian plane.

The table is right, and by as much as the star time clock differs from it, the latter is wrong. No attempt is made to set the star clock right, allowance being simply made in subsequent calculations for the error thus discovered, which amounts only to a fraction of a second in some days. Next the corrected time, as taken from the star clock, is reduced to sun time, which requires some figuring, inasmuch as the star year is one day longer than the sun year. A sun time or "standard" time clock stands close by, and the amount that this varies from the truth having been ascertained, allowance is made for the error in sending the noon stroke all over the country.

REGULATING CHRONOMETERS.

At the observatory all the chronometers made for the navy are tested and regulated before they are sent out on vessels, each one of which is supplied with three first class chronometers, as well as one that is half used up, called a "hack," for carrying about and for rough service generally. It takes twenty-one weeks of testing to properly regulate and prove a chronometer, and part of the trial consists in subjecting the instrument to the action of cold in an ice box and to heat communicated through steam pipes. Each chronometer, when given out, is accompanied by a chart telling just how it will vary under certain temperatures. A curious exhibit now shown at the observatory includes eight chronometers that went down in the great gale that swamped a fair part of Uncle Sam's navy at Samoa. Their glasses are broken and their works so far used up that they are no good any longer.

Rules for Distributing Oil, as Recommended by the U. S. Hydrographic Office.

1. Scudding before a gale, distribute oil from the bow by means of oil bags or waste pipes. It will thus spread aft and give protection both from following and quartering seas. If only distributed astern, there will be no protection from the quartering sea.

2. Running before a gale, yawing badly and threatening to broach-to, oil should be distributed from the bow and from both sides, abaft the beam. Where it is only distributed at the bow, the weather quarter is left unprotected when the ship yaws. With oil abaft the beam, as well as forward, the quarter is protected.

3. Lying-to, a vessel can be brought closer to the wind by using one or two oil bags forward, to windward. With a high beam sea, use oil bags along the weather side, at intervals of 40 to 50 feet.

4. In a heavy cross-sea oil bags should be hung out at regular intervals along both sides.

5. Steaming into a heavy head sea, use oil through forward closet pipes. Oil bags would be tossed back on deck.

6. Drifting in the trough of a heavy sea, oil from waste pipes forward and bags on weather side. These answer the purpose very much better than one bag at weather bow and one at lee quarter.

7. Lying-to to tack or wear, use oil from weather bow.

8. Cracking on, with high wind abeam and heavy sea, use oil from waste pipes, weather bow.

9. Towing another vessel in a heavy sea, oil is of the greatest service, and may prevent the hawser from breaking. Distribute oil from the towing vessel, forward and from both sides. If only used aft, the tow alone gets the benefit.

10. At anchor in an open roadstead, use oil in bags from jib boom, or haul them out ahead of the vessel by means of an endless rope rove through a tail block secured to the anchor chain.

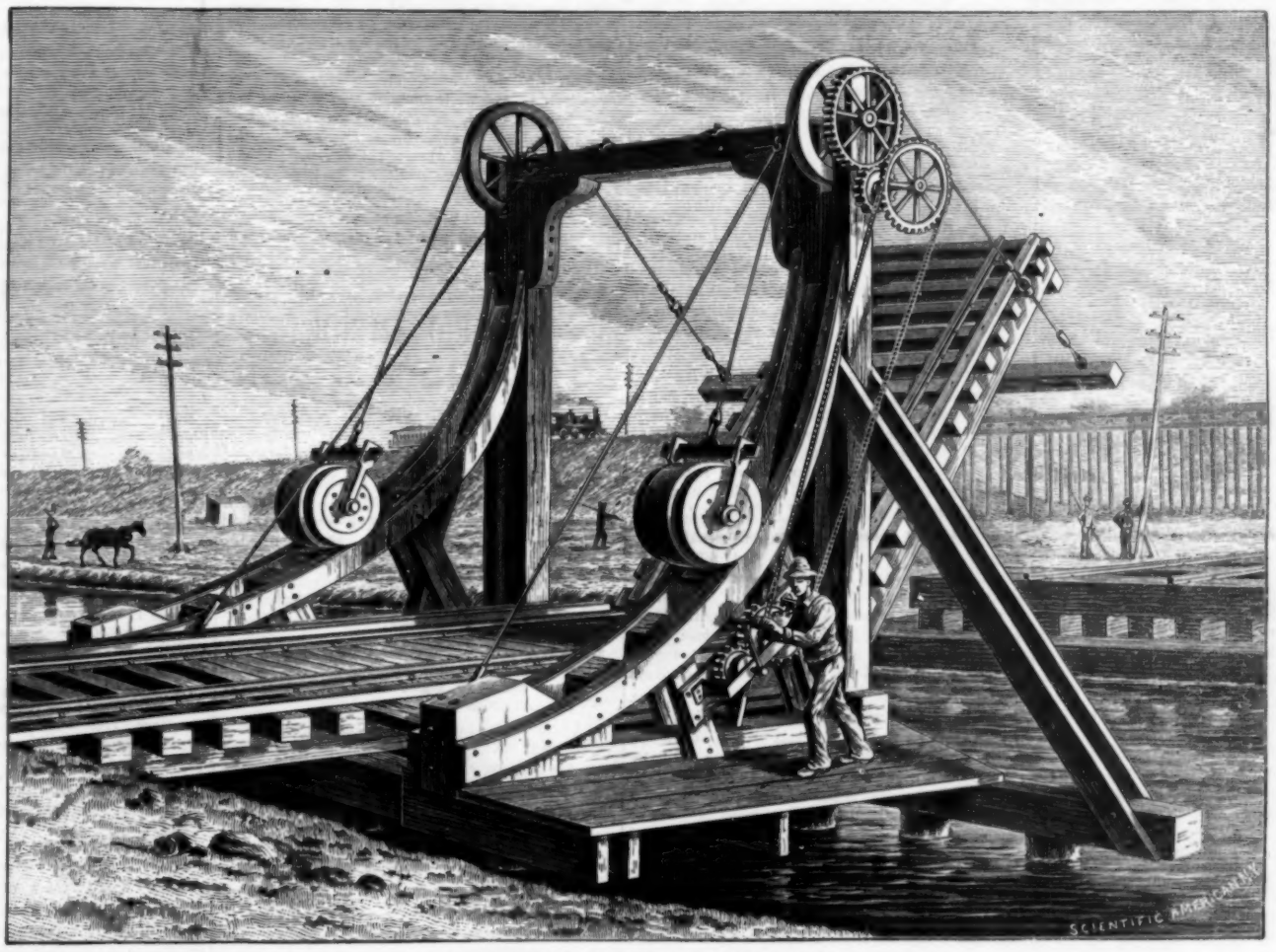
11. A vessel hove-to for a pilot should distribute oil from the weather side and lee quarter. The pilot boat runs up to windward and lowers a boat which pulls down to leeward and around the vessel's stern. The pilot boat runs down to leeward, get out oil bags to windward and on her lee quarter, and the boat pulls back around her stern, protected by the oil. The vessels drift to leeward and leave an oil-slick to windward.

Armor-Piercing Projectiles.

Bids have been received by the Ordnance Bureau of the War Department at Washington for supplying armor-piercing projectiles for the new steel guns now being constructed for sea coast defense, as follows: Carpenter Steel Company, of Reading, Pa., 8 inch shot, $150 each; 10 inch shot, $285 each. Midvale Steel Company, of Pennsylvania, 8 inch, $150'; 10 inch, $287. Sterling Steel Company, of Pittsburg, 8 inch, $300; 10 inch, $575. For the purpose of securing a supply of armor-piercing projectiles, Congress appropriated $100,000 to decide the question whether or not American steel makers can produce shot and shell equal to those made in Europe. The projectiles used in the Annapolis armor tests with such success were of European manufacture, and it is the desire of the ordnance officers to stimulate steel makers to produce an equally powerful projectile in this country. Two of the bids received are said to be reasonable in amount, the average price being about 50 cents a pound. Just how the projectiles are to be made is not specified in the bids. The Carpenter Steel Company has, it is believed, secured the right to make them under the Firminy secret process, used in England, but it refuses to permit the process of manufacture to be observed. The Midvale Company has been in correspondence with four leading firms of European shell makers, and, while it is willing to permit the manufacture to be witnessed by an inspector, the process is to be kept secret. The Sterling Company has been working up its own process, and purposes to use the best crucible steel made from Dannemora iron. The requirements of the Ordnance Bureau are based upon European tests, and are severe. The 10 inch shot, which will weigh 570 pounds, will be fired at a velocity of 1,635 feet a second, and must pierce a steel plate 11·2 inches thick, and emerge without crack or material deformity. The 8 inch shot, fired under the same conditions, must pierce a plate of 9 inches thick.

A COUNTERBALANCED DRAW BRIDGE.

There is a new railroad bridge over the Morris Canal between the towns of Jersey City and Lafayette, N. J., which from its simple construction and easy manipulation is worthy of notice. The draw of the bridge, which is about 25 ft. long, is manipulated by hand power. The entire length of the bridge is 55 ft. The principle of operation is clearly shown in the accompanying illustration. The weight of the draw being about three tons, two counterbalanced weights are employed weighing three thousand pounds each, made of cast iron in the shape of a cylinder, about 3 ft. in diameter, and mounted in such a way as to be rotatable on their axes. These weights are designed to run in tracks which are laid in an ellipse on an inclined framework extending from near the top of the central framework to the level of the roadway of the bridge. Wire cables connect the counterbalance weights with the free end of the draw, the cable passing once around the pulleys at the top of the framework. The pulleys are mounted upon a three inch shaft which extends along the top of the central cross beam, and which is provided at its right hand extremity with a pinion 2½ ft. in diameter. This engages with a small pinion that is mounted on the shaft that is rotated by the endless chain from below. The draw is almost balanced by the weight of the rollers, but the system of pulleys employed renders it possible for one man to raise an enormous weight at the end of the draw without any inconvenience. The bridge was built for a single track railway bridge, and although it has been in service only a short time, it has proved very efficient.



A COUNTERBALANCED DRAW BRIDGE.

Free Lectures in Public Schools.

A bill was passed by the New York legislature in 1888, providing for free lectures in the public schools of this city. On the evening of November 17 a course of lectures was commenced in six different grammar schools, and from the *World* and other daily papers we learn they were all well attended. Professor C. A. Doremus lectured on "Fire and Water," illustrating his subject with interesting chemical experiments. Mr. James Bowie lectured on "Paris and the Great Exposition." Doctor Charles S. Wells took his audience "A Tour on the Nile," with stereopticon views. Professor Henry A. Mott discussed "Light and Color," made clear by experiments. Mr. William Bradford gave "Glimpses of the Arctic Regions," giving a graphic description of life in the far North.

But perhaps the most useful and interesting lecture was that of Doctor James E. Newcomb, on "Every-day Accidents and how to Treat Them." It was replete with hints as to "what to do till the doctor comes," made clear by interesting illustrations.

"There are two rules which should be followed in case of an accident," said the doctor. "First, common sense should be used; second, the person should be made as comfortable as possible."

After describing the human body, Dr. Newcomb spoke of the every-day accidents met with.

"To tell a broken bone," he said, "examine carefully the part supposed to be injured and compare it with the same part on the other leg or arm, as the case may be. There will be an indentation or a swelling to indicate a fracture. Now, what should be done in case of a fracture? Restore the limb to its proper shape and then let nature takes its course. The doctor sets the bone, nature does the rest."

Dr. Newcomb here illustrated how a bone is set in an emergency case. He showed how splints could be made from common pieces of wood picked up on the street. Then he called to the platform a boy, and showed how the injury should be bandaged.

"Never put a splint next to the skin," remarked the lecturer. "Always put something between—cotton, a piece of rag, anything soft will do. Give the injured organ rest, don't irritate and excite the person injured.

"In the case of a broken rib, wind the bandage all the way around the body. If the shoulder bone or any other joint is dislocated, bear down and press upon the separated parts to put them together again.

"For a sprain get some hot water, as hot as you can bear it, and keep the foot or hand in it for an hour or an hour and a half. If it is a part you can't put in hot water, put hot cloths on. After having applied these preliminary remedies, wait till the physician comes.

"In regard to wounds. If it is a clean-cut wound, see that it is kept clean by repeated applications of water. That is the main thing. Cleanliness is an essential part of the treatment of all wounds. It is half the cure.

"All wounds made by bites, like dog bites, are likely to be sore and painful. It is always a good plan to cauterize a dog bite.

"Always use water for a burn. Before you attempt to remove the clothes from a person burned, drench him or her with water. Next, take care to keep the wound from the air. Sweet oil is one of the best temporary dressings to give relief, and keeps the air out. Baking soda is the best for burns from scalding water.

"Another very common and serious accident is loss of blood by hemorrhage. If a scalp wound, take a small piece of cloth, wash away whatever little clots of blood there are, then put the cloth over the wound and keep it there for twenty-four hours. A hemorrhage of the arm may be stopped by pressing together the tubes or arteries through which the blood escapes. The openings may also be plugged up and then bandaged until the doctor arrives.

"For hemorrhage of the lungs ice is a good remedy, and in case of hemorrhage of the nose, cold water may be dashed on the neck."

In regard to the restoration of apparently drowned people, Dr. Newcomb advised that, unless in particularly inclement weather, no time should be wasted in removing the patient to a place of shelter.

First, every garment should be loosened, so that nothing could impede the free flow of blood. Second, the patient should be laid on his back and then face downward. The next thing to be done is to create artificial breathing by moving up and down the arms fifteen or twenty times a minute, which should be kept up as long as there is the faintest sign of life. Besides this, the limbs should be rubbed, and this treatment kept up for at least an hour.

In all cases of poisoning the best thing would be to administer an emetic. Mustard is commonly used for this purpose, and if an emetic be not handy, a finger should be forced down the patient's throat to produce vomiting.

Strong poisons were likely to irritate the stomach, and for this common mucilage is good, and to get the stomach in good condition again, aromatic spirits of ammonia should be administered.

Ashtabula Harbor.

Owing to the growing importance of the port of Ashtabula, Ohio, an effort will be made to have Congress vote a sufficient sum of money to enlarge the entrance and construct a breakwater there. The ore receipts at Ashtabula are in excess of all other Lake Erie ports, and the volume of trade is largely increasing, so much so that a prominent vessel owner in Cleveland states that he would not be surprised to find that Ashtabula would increase her tonnage list next year by fully 20 per cent over the phenomenal total of the present season. There can be no doubt, however, that the port of Ashtabula is becoming the greatest ore center on Lake Erie, and facilities for establishing the port should be awarded with a liberal hand by the government. It matters not under what administration, or political bias, the House may be ruled *pro tem.*, nor by whom individually the necessary legislation tending to foster and encourage commerce is introduced before the legislators of our land—suffice it to say that where important and valuable commerce is desirous of centering, the federal authorities should liberally assist and encourage it by the aids and facilities which lie in their power to grant.

That Ashtabula can already lay claim to being a prominent lake port may easily be verified by the arrivals and clearances of United States tonnage during the present season, and for distinctively domestic tonnage the past four months arrivals at that port compare favorably with any port on the New England or Pacific coasts. Such being the case, it would be difficult to conceive why such a port should not receive a full and complete consideration at the hands of our representatives during the next session of Congress. Vessel owners, mine owners, railroad companies, and all corporations interested in the welfare of the lake marine, and the speedy transportation of the country's products, are in unison of interest regarding the future development of Ashtabula as an ore-receiving port, and there can be no doubt but that it is destined to become an important lake terminal. We therefore strongly indorse any legislative measures tending to the advancement of Ashtabula as a shipping port, and also as a harbor of refuge.—*Marine Record.*

RECENTLY PATENTED INVENTIONS.

Electrical.

CLOCK.—Frank Schwartz, Halifax, Canada. This invention provides a mechanism for utilizing electric force to accurately regulate the impulse of a pendulum near the terminals of its vibratory arc, forming a compact and trustworthy time marker, to operate continuously without other attention than the renewal of fluids in battery cells.

METER.—Etienne Mares, Paris, France. Actuated by an electro-magnetic device is a balancing lever mounted to oscillate, there being a carriage on the lever, with mechanism for reciprocating the carriage, and a separate and independent registering device in the path of the carriage, the meter being especially adapted for measuring electricity and other fluids and substances.

Railway Appliances.

CAR COUPLING.—Edgar Canniff, New Westminster, Canada. This invention provides means whereby the link may be held in horizontal position, or canted up or down as occasion may demand, and whereby also the coupling or uncoupling may be effected from the side or top of the car, with the brakeman in the sight of the engineer.

Treating Ores.

ROASTING.—Edwin M. Clark, Butte City, Montana. This invention relates to an apparatus for roasting ore a sufficient time to destroy the sulphur, and consists chiefly in the manner in which the water jacket is applied to the air pipe in the furnace, and the means for supporting the water jacket and connecting it with the water pipe.

OXIDIZING AND DESULPHURIZING ORES.—The same inventor has obtained a further patent on an improved construction of this apparatus, designed to accomplish the result in a short time and at little expense, in which a water jacket, inclosing an air pipe, extends through a revoluble furnace, with jets projecting from the air pipe through the jacket.

Agricultural.

HARROW AND CULTIVATOR.—Fred G. Umbach, Athens, Ga. This invention provides a simple and durable construction of harrow to which, when desired, a cultivator tooth may be attached, whereby the implement, as drawn forward, will perform the dual functions of a harrow and a cultivator, the cultivator tooth and the harrow teeth being readily detached and replaced as desired.

Mechanical.

FRICTION WRENCH.—James N. Farlow, Lander, Wyoming. This wrench has a circular head-plate having adjustable jaws mounted therein, and a handle composed of two members hinged together at one end and adapted to be clasped upon the head plate, forming a wrench which may be readily applied to any form of nut, and that may be used in places where an ordinary wrench cannot be applied.

POWER TRANSMITTER.—Thomas C. Hutchinson and Trevanion W. Hugo, Duluth, Minn. This is a machine for alternately taking up and letting out a rope or chain attached to some device or operating some subsidiary mechanism located at a distance, the rope being wound on drums whose rotation is reversed at regular intervals by automatic mechanism, the power being derived from a shaft rotating continuously in one direction.

SLATE JIG.—James N. Boone and Samuel D. Taylor, Hazleton, Pa. This invention provides a suitably constructed frame, in which a screen is held to swing by means of links, and provided with a pocket for the reception of the slate, the pocket also forming a passage for the coal, to separate slate from coal and clean the latter without the aid of water.

ROLLER MILL.—Louie E. Kruger, Canton, South Dakota. Combined with the frame and the rolls are inclined vertically reciprocating upper and lower screens, with other novel features, forming a mill designed for the continuous treatment of stock in such manner that after the first reduction all particles sufficiently fine will be sifted out, being joined afterward by other products fined by other sets of rolls, the bran, flour, and middlings being delivered in separate streams.

BANDS FOR SPINNING MACHINES.—Henry G. Hall, Shelby, N. C. This invention relates to the manufacturing of bands for spinning and twisting machines and a machine therefor, in which the band is stretched after it has been shortened by twisting, and extra twist put in, afterward subjecting it to tension for the twist to become set.

Miscellaneous.

INVALID BED APPARATUS.—Frank M. Collins, Walden, N. Y. This is an apparatus designed to facilitate taking care of the sick or injured, the invention covering novel features of construction and combinations of parts to promote the easy and convenient lifting of patients, the changing of their position, the service of meals, etc., and for sustaining a fractured or diseased limb comfortably while allowing general freedom of movement.

WINDOW BLIND.—John P. Clark, Jr., Jackson, Mich. This is a vertically slatted blind in which the vertical wooden strips are longitudinally grooved on each side and hinged together, the grooves of one side being opposite ribs on the other side, while a vertical rectangular bar is hinged to the window frame at the sides and also to the corrugated strips flatwise, making a cheap, convenient, and substantial inside blind for a window.

PUMP ATTACHMENT.—Jonathan A. Beard, Hildreth, Neb. The pump barrel is provided with a waste outlet, the valve of which extends in the path of the pump rod, with other novel features, providing improved means for the speedy emptying of the pump barrel of a hand or power actuated pump, to avoid injury to the pump from freezing.

SHEARS.—Richard S. Pearsall, Sea Cliff, N. Y. The thumb clip of these shears is hinged at its center to the rear extremity of the shank of the lower blade, to tilt back toward the finger eye or loop of the other shank, the thumb clip being adapted to tilt back to an approximately unlimited extent, while the shank of the lower blade is curved upward to furnish room and a better grip for the front finger of the user.

BASKET.—Merrill H. Tilghman, Norfolk, Va. This is an improved truck basket or package, having braces arranged in pairs, the braces of each pair being arranged diagonally in opposite directions to cross each other at their middles, rendering the basket strong and rigid in all directions.

PEACH STONER.—John C. Bryan, Fordyce, Ark. A seat for the fruit is provided in a stationary base plate above which a circular knife is arranged to reciprocate, an upwardly operating plunger driving the stone through the knife up into a passage way or throat, the device in a single operation removing the stone and slicing the peach into two or more sections in an expeditious and economical manner.

GLOBE AND LAMP SHADE.—Otto F. Wegener, Seattle, Washington. This invention relates to shades of a segmental character, which do not extend all the way around the lamp, but swing radially in a circular path, being adjustable vertically to any desired height, the invention covering a novel construction and arrangement of parts.

SELF-CLOSING GAS BURNER.—William W. Sherman, San Francisco, Cal. This invention covers a special form of thermostatic spring to be applied to the burner to hold the cock open when it is hot, or when the gas is burning, but liberating the cock so as to make it self-closing when cool, to prevent accident and loss of life from the escape of gas when the burner is not lighted.

VENTILATING FLUE.—Carey F. Hall, Dunkinsville, Ohio. This invention relates particularly to a ventilating collar or register surrounding a metallic flue where it passes through a floor, roof, or attic partition, and provides a means for ventilating one or more rooms, and also to render a flue as nearly fireproof as possible.

STIRRUP LEATHER SUSPENDER.—Gustave Biebuyck, Brussels, Belgium. This is an improved safety saddle bar or suspender for stirrup leathers, of simple construction and easy of application, to cause the stirrup leather to be released automatically in case of accident, and to render it impossible for the rider when thrown to be dragged by the animal, from the foot becoming entangled in the stirrup.

ALBUM AND ALBUM SUPPORT.—Bernard Branner, New York City. This album consists of duplicate books which meet at their backs and are retained so connected as to permit the free folding of the leaves of each section by an encircling band secured at the point of junction of the sections, while the device is provided with a pivotal support upon a stand or frame to facilitate inspection of the contents of the album.

COIN OPERATED MACHINE.—Frederic B. Cochran, Brooklyn, N. Y. This is designed to be a simple and inexpensive machine to deliver goods by means of a plunger actuated from the outside of the casing, and producing music as each piece of goods paid for is delivered, the machine being operated by depositing a coin in the casing, and especially adapted to sell confections, cigarettes, or other small wares.

MORTAR MIXING APPARATUS.—Edward D. Johnston, New York City. A rotatable separable cylinder for the mixture of the ingredients is loosely mounted on a fixed shaft to which a coarse sieve is attached, a scraper supported by the shaft being adapted to scrape mortar from the sides of the cylinder upon the sleeve, whereby mortar and similar compounds may be quickly, cheaply and efficiently mixed.

BREWING BEER.—Michael Byrne, New York City. This invention relates to an improvement in what is known as a wort pan, whereby the wort may be obtained at a higher and more regular temperature and protected against scorching or coloration, and also provides against the wort cooling down as delivered by the taps of the mash tub, the arrangement being such that the wort may be drawn from the pan without loss and in a convenient and expeditious manner.

HORSE DETACHER.—John H. Akers, Washington, D. C. This is a device in which a spring-actuated bolt is employed for each shaft, while the traces are connected by peculiarly constructed buckles so arranged in connection with the shafts and the breeching that the trace sections and the shafts can be quickly detached by the driver to allow the animal to run free from the shafts when desired.

CART LOADER AND SWEEPER.—Joseph A. Schonley, Brooklyn, N. Y. This is an attachment for the rear of a cart by which a broom is held in contact with the ground, and, as the cart is drawn forward, the sweepings are forced up the inclined surface of a dust pan into the buckets of an elevator, by which they are dumped into the cart body, the broom and dust pan being elevated by levers when the cart is full.

HORSESHOER'S IMPLEMENT.—William H. Woodman, Columbia, South Dakota. This is a combination implement including clinching jaws for the nail point held normally open by a bowed spring, nippers for cutting off the point, and a gouge for forming a depression in the wall of the hoof for receiving the clinched point of the nail, whereby the farrier is enabled to expeditiously perform his work.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

AIR BRAKE PRACTICE. By J. E. Phelan. Press of the *Locomotive Engineer*, New York. Pp. vi, 105.

A very complete manual of the Westinghouse system of train braking is here presented. In view of the almost universal adoption of the Westinghouse brake, and the probable increase in the use of it in the future, a manual of this sort appears very timely.

PRACTICAL SANITARY AND ECONOMIC COOKING ADAPTED TO PERSONS OF MODERATE AND SMALL MEANS. By Mrs. Mary Hinman Abel. Published by the American Public Health Association. 1890. Pp. xi, 190.

This work is a prize essay to which the first prize of $500 was awarded by the American Public Health Association. Its value was the greater as it was written in competition with sixty-nine other essays. It is really a scientifically arranged cook book, and with the recommendation of excellence following upon the approval of the association that publishes it, it should meet a wide demand. A number of bills of fare for different days, with the chemical analyses and cost of same, and a table of cold dinners are given toward the end of the work. We commend it warmly to all housekeepers.

THE OLD MEETING HOUSE AND VACATION PAPERS. By Rev. C. Z. Colton. New York: Worthington Co. 1890. Pp. 298. Price $1.

This elegantly printed work contains a series of papers, humorous and serious, by the Rev. C. Z. Colton. They are arranged for publication by his brother. The titles carry the reader back to the world of forty years ago, and the subjects are excellently treated by the eminent divine, their author. The old-time life in the Green Mountain State is brought vividly before the reader in some papers, while the author's early experiences in other New England States also appear. The book has as frontispiece a portrait of the author, while a front view of "the old meeting house" is imprinted on its cover.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published.

Address MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER NUMBER.—(No. 61.)

TABLE OF CONTENTS.

1. Plate in colors of a modern dwelling of pleasing design at West End, Chicago. J. De Howarth, architect, Chicago. Floor plans, perspective view, sheet of details, etc.
2. Elegant colored plate showing perspective view of a $1,400 cottage at Chicago. Two floor plans, sheet of details, etc. Architect J. M. Young.
3. Design for an entrance hall.
4. An attractive dwelling at Hollis, Long Island, erected at a cost of $6,000 complete. Perspective view and floor plans. Schweitzer & Diemer architects, New York.
5. A neat-looking cottage at Humboldt Park, Chicago. Cost $3,200. Photographic perspective view and two floor plans.
6. A colonial house erected for Mr. C. A. Hutchings, at Montclair, N. J. Cost $5,000 complete. Floor plans and perspective elevation.
7. A Flemish cottage erected in Philia Park at Wayne Pa., at a cost of $5,800 complete. Perspective view and floor plans.
8. A house erected at Elm Station, Pa., at a cost of $5,200. Photographic perspective view and floor plans.
9. Perspective elevation and floor plans of a handsome cottage at South Orange, N. J. Charles B. Atwood, New York, architect. Cost $13,000 complete.
10. Engraving showing a block of economical brick houses erected at Philadelphia, Pa. Cost $2,000 each. J. M. Stiller, of Philadelphia, architect. Floor plans and perspective.
11. Perspective and floor plans of a Lake Side cottage at Minnetonka, Minn. Cost about $4,000. W. H. Dennis, architect, Minneapolis.
12. Miscellaneous contents: Some of the merits of the ARCHITECT AND BUILDERS EDITION of the SCIENTIFIC AMERICAN.—The air supply.—The Alhambra.—Decoration of entrance hall, illustrated.—Questions on construction.—The Henry Martin brick machine, illustrated.—Buckeye Portland cement.—A government contract for woodworking machinery.—Architects' and carpenters' transit, illustrated.—Improved dwelling houses, illustrated.—Dumb waiter and hand power elevators.—Improved double blind wiring machine, illustrated.—An improved boiler for power and heating, illustrated.—Resistance to fire of wood posts.—An improved door spring, illustrated.—An improved hot air furnace, illustrated.—The Taylor "old style" roofing tin.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale—New and second hand iron-working machinery. Prompt delivery. W. P. Davis, Rochester, N. Y.

Wanted.—A company extensively engaged in the manufacture of steam boilers for large power plants is desirous of securing the services of several experienced salesmen, possessing a practical knowledge of steam and good business qualifications. Address, with references and full particulars, Manufacturer, Box 773, New York.

Acme engine, 1 to 5 H. P. See adv. next issue.

Presses & Dies. Perracute Mach. Co., Bridgeton, N. J.

Flour emery a specialty. New process. No dust. All grit. The Tanite Co., Stroudsburg, Pa.

Best Ice and Refrigerating Machines made by David Boyle, Chicago, Ill. 155 machines in satisfactory use.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Power presses and dies. Also contractors for special machinery. T. R. & W. J. Baxendale, Rochester, N. Y.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 301.

Billings' Patent Adjustable Tap and Reamer Wrenches. Bronze Forgings. Billings & Spencer Co., Hartford, Conn.

For Sale—Valuable invention: self-oiling car axle for mine cars. Patented April 1, 1890. A good thing for the right party. Address R. P. Sholl, Bartonville, Ill.

For Sale—One half interest in a valuable patent for Europe and the old world. Address "Lewis," care Scientific American, New York.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Sheet Rubber Packing, 1-16, 3-32, 1/8, 3-16, and 1/4 inch thick, 7½ cents per pound. All kinds of rubber goods at low prices. John W. Buckley, 156 South St., New York.

Blake's improved belt studs are the best fastening for leather and rubber belts. Registered trade mark and picture on every box. None other genuine. Greene, Tweed & Co., 83 Chambers St., N. Y. City.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions, etc. ☞ *A profitable business for a man with small capital.* Also lanterns for home amusement. 208 page catalogue *free*. McAllister, Optician, 49 Nassau St., N. Y.

Wanted—A competent foreman for a machine shop employing about 50 men; the foreman to work under the instruction of a general superintendent; salary moderate; works located in a small and pleasant town near Cleveland, O. Applicant must come well recommended as to character, experience, and ability. The works are engaged in manufacturing heavy machinery. A permanent and desirable opening for a good man. Address Foreman, care Scientific American, New York, stating age and giving references.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2595) Amateur Photographer asks: 1. Please give me a good toning formula and how many 4 × 5 prints will a given amount of the solution tone, and how long will it take? A. See page 225, April 13, 1889, SCIENTIFIC AMERICAN. 1 grain of gold will tone 1 sheet 18×22 inches. Usually takes ten minutes. 2. Will the common ammonia such as all druggists sell do to fume sensitized albumen paper? A. Yes. Get the strongest you can. 3. Please give formula for a silver sensitizing bath. How much will be required to sensitize 1 dozen 4×5 sheets of paper at a time? How long must the paper remain in the bath? A. See April 13, 1889, SCIENTIFIC AMERICAN; also August 2, 1884, in Photo. Notes. You buy albumenized paper in sheets 18 × 22 and sensitize it all at once, then cut up to 4× 5 size. The paper is floated for 3 minutes, on the silver bath. The bath will keep, if bottle is corked. Clear the bath by putting it in sunlight. 4. Give receipt for making a mounting solution or paste for photographs, one that will hold tight and not curl up and leave the card around the edge. A. Most photographers use ordinary freshly made starch paste. The following is also recommended:

Nelson's No. 1 photographic gelatine	1 gr.
Water	16 oz.
Glycerine	1 "
Methylated alcohol	8 "

Dissolve the gelatine in warm water, then add the glycerine, and finally the spirit. 5. How can I treat unmounted albumen prints so they will remain flat and

not curl up? A. Immerse the finished prints in following solution for a few minutes:

Water	1 part.
Alcohol	4 "
Glycerine	3 "

(2596) R. T. C. asks for the cause of explosion in kerosene lamps, and if the cause is attributable to the generation of a combustible gas, what gas is it? A. It is due to the generation of a gas which accumulates in the lamp above the oil, and which when mixed with the right proportion of air is the cause of an explosion when inflamed by the flame. It is probably an olefine or paraffine. True explosions are comparatively rare. Lamps upsetting or cracking from overheating, etc., are the basis of many so-called explosions.

(2597) Java asks: *a.* How is a very soft-toned portrait to be made with the alkaline (pyro and ammonia) developer? My portraits are wanting in softness. I tried to omit bromide entirely, and made my best plate that way, still as treatises never mention this way of doing, which at the best can only be done with exactly exposed plates, I suppose there must be another and better one. A. The pyro and carbonate of soda developer will give softness. Dissolve in—

Water	6 oz.
Sodium sulphite	2 drs.
Sodium carbonate	2 "

and just before using add

Dry pyrogallic acid	3 grs.

Should the density be too weak, put in twice the quantity of pyro. The softness is regulated by the quantity of pyro. No bromide is necessary. The eikonogen developer also gives soft negatives. Mix the eikonogen as follows:

No. 1.

Sodium sulphite c. p.	2 oz.
Eikonogen	1 "
Water	40 "

No. 2.

Sodium carbonate	1 oz.
Water	10 "

To develop, take 2 ounces of No. 1 add 1 ounce of water and half an ounce of No. 2, or if necessary to bring out the picture quickly, add instead 1 ounce of No. 2. If the negative is too hard, use 1 ounce of No. 1, dilute it with 2 ounces of water and add half an ounce of No. 2.

b. My prints have a knack of getting yellow stained in the whites by the rolling process especially if mounted on black cards. What may be the reason of this? I use the best mounting pastes in the market. A. Perhaps the hypo bath was old, or the washing water may be impure. Yellowness is sometimes caused by leaving the prints in the hypo too long, or by impurities in the mounts. Try light-colored mounts. Add a little bicarbonate of soda or a drop or two of ammonia to the fixing bath.

c. Before rolling I rub my prints with soap. Is there not a better medium for getting a fine, glossy print? Would you give me the recipe? A. The following lubricator is recommended by John R. Clemons, in Wilson's "Photographics:"

A.

Paraffine	8 drs.
Benzine	10 oz.

B.

Gum ammoniacum	30 grs.

Alcohol quantity sufficient to prevent the gum from sticking to the pestle while grinding the gum in a mortar. Add A and B together, and shake well and apply with a flannel or rag. The above gives a fine polish.

d. Please to tell me how to make a good paint for backgrounds, that will not crack? A. Mix common oil paint with a strong, hot solution of soap. When applied to the background as ordinary paint, it dries with a dull surface and is said not to crack.

(2598) H. W. asks: 1. In the liquefication of gases, or the reliquefication of a liquid that has been vaporized, is it the cold or the pressure that exerts the most influence in the liquefication? A. For each gas there is a critical temperature above which no pressure will liquefy it, and a critical pressure below which no reduction of temperature will liquefy it. 2. In answering question 4 of No. 1694, of December 28, 1889, you say the 8 light dynamo increased to twice the size would develop about 5 horse power used as a motor. Would that power be sufficient to vaporize and reliquefy sufficient ammonia (anhydrous) to freeze 5 tons of ice in twenty-four hours? A. For information on artificial ice making we refer you to our SUPPLEMENT, Nos. 215, 254, 288, 335, 338, 550, 551, 578, 605, 722, 726, 749, 757. 3. Please give different mixtures of chemicals for production of low temperatures. Please give proportions and lowest degree of temperature obtained.

A. Sulphate of soda	8 parts.
Hydrochloric acid	5 "
Cools from 50° Fah. to 0° Fah.	
Sulphate of soda	6 parts.
Nitrate of ammonia	5 "
Dilute nitric acid	4 "
Cools from 50° Fah. to −14° Fah.	

If acids are objectionable, nitrate of ammonia 1 part, water 2 parts may be used.

(2599) W. H. McC. asks: What acid can I use with marble dust to produce a gas that will raise a small balloon? A. No acid. Use zinc and dilute sulphuric acid, which produce hydrogen gas. Marble dust with acid produces carbonic acid gas, which is heavier than air.

(2600) G. A. J. asks the value of 50½ decimally. Is it 5·05 or 5005? A. 50·5.

(2601) E. F. asks how to make marine glue. A. Soften one part masticated India rubber in 12 parts benzine, add 20 parts shellac and heat carefully until perfectly mixed. The benzine is expelled by the heating and its vapor is very liable to cause a conflagration. Too great care cannot be exercised in conducting the operation.

(2602) J. G. T. asks: 1. I wish to know how to prepare snake skins to be kept flat, *i. e.*, not stuffed, and would be glad if you would mention the name of a good disinfectant to be used in connection therewith. A. After cleaning the inside of the skin, sprinkle powdered alum on the surface, and after a day work it off again. 2. Would like to know in what countries spiders may be found the bite of which is dangerous to life. A. Such are to be looked for in the tropics especially. 3. Why does a banjo make a better impression upon a phonograph than a guitar, although played no louder? A. It is doubtful if it does. Possibly it has fewer overtones.

(2603) O. W. H. writes: I am a shoe finisher by trade, and we have to keep up with times. Have you any books, receipts, or formulas treating on the subject of making stains for finishing the bottom of shoes? A. The following purports to be a receipt for finishing hemlock sole to resemble oak: Take one ounce each of borax and oxalic acid and dissolve them in one quart of water. Be sure not to get more of the acid than the borax, use sooner a little less. After sandpapering the bottom, damp down or wet the grain with this solution, and when nearly dry apply white bottom balls in the usual way. French chalk or pipe-clay may be used instead. This process brings out a fine white bottom, though it is slightly tinged with pink. If a yellowish shade is required instead of the "pinky" color, a small quantity of chromic yellow should be added to the borax and acid. It has this disadvantage, and all "finishes" have the same, viz., if the bottom hangs in the damp when in stock, the red color works through. We cannot recommend you any practical book on the subject you mention.

(2604) H. I. asks: 1. What kind of battery is best suited for electric lighting? A. Probably nothing is better than the Bunsen. 2. The number of cells per 16 candle power lamp? A. You will require enough cells in series to secure the required E. M. F., and enough in parallel to produce the necessary current. The number of cells will be determined by the resistance of your lamp. See SCIENTIFIC AMERICAN, March 22, 1890, page 179, and March 29, 1890, page 195. 3. The cost of running it, per lamp, for 5 hours? A. The cost would vary under different conditions, but in any case it would be more than that of gas. 4. And, also, a good book on the subject. A. "Experimental Science," price $4, would probably meet your wants.

(2605) A. H. L. asks for a preparation or paint to apply to shingles of a roof, to preserve the shingles, and a guard against fire. In other words, I am about to build me a home, and wish to dip or paint the shingles with some kind of paint that will both preserve them and be proof against catching fire from sparks. A. Dissolve in a barrel of hot water:

Sulphate of zinc	20 lbs.
Alum	20 "
Caustic potash	8 "
Manganic oxide	8 "
and add	
Sulphuric acid	8 "

Pack the shingles loosely in another barrel and fill with the liquid, holding the shingles under the mixture. Fill up the first barrel also with shingles, soak for 3 hours and pile to dry, and repeat until all the shingles are fireproofed. After the house is shingled paint with oxide of iron paint, tempered with other mineral color in boiled linseed oil, and mixed to suit your taste as to shade of color.

(2606) I. X. L. writes: I am under 25 years, having common school education, and some experience in telephone business. I wish to get an electrical education, and cannot attend school, but must be self-taught. 1. What studies, in their proper order, are best for me to pursue? A. Study physics, mathematics, and mechanical engineering. You will have to compete with college students. 2. What department is best for me to make a specialty? A. Make no department a specialty except after you are established in the profession. You must take any opening, however low, and trust to work up. 3. What department, or departments, in the near future will demand best pay? A. This admits of no answer. Pay will depend more on the man than on the department. The road to good remuneration is an uphill one. If in any kind of electrical position, stick to it and study in your evenings.

(2607) J. B. asks: 1. Having trouble with moths eating plush silk furniture, can you furnish me a preventive? Also what will I procure to destroy the present annoyance? A. Thorough cleaning, beating, and brushing is the best cure. Treatment by a naphtha laundry is efficacious. 2. What do paper hangers make paste of that has such a consistent body and adhesive qualities? A. Use rye flour paste. Mix the flour with a little water to a perfectly smooth mess, then add more water and cook. The paste may be passed through a fine screen if desired. If properly manipulated, this will not be necessary; some glue may also be added.

(2608) M. D. asks: What is the effect on torsional strength of boring out a steel or iron shaft, i. e, will a shaft of given diameter bear greater torsional strain after being bored out? A. It will not. The idea is derived from the general statement in technical works that tubular shafts are stronger than solid shafts for equal weight.

(2609) J. T. writes: Working with a solution of 1 gramme tannin in 100 grammes water, some linen clothing and handkerchiefs got wet with it, and after washing all parts wet with that solution appeared stained a dark brown color. What can be used so as to take away the stains without destroying the fabric? A. Try citric acid solution to remove tannic acid stains, if this does not suffice, use a mixture of oxalic and citric acids in equal parts.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

November 18, 1890,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising sign, E. & F. Smith ... 440,779
Air accumulator, W. F. Merryman ... 441,119
Air brake releasing attachment, G. B. Williams (r) ... 11,124
Aluminum plates, manufacture of compound, C. H. Land ... 440,952
Amalgamator, J. B. Brewster ... 441,080
Anvil mould, T. W. Vare ... 441,040
Automatic gate, A. Edwards ... 440,936
Awning slide or runner, H. C. Rector ... 441,021
Axle lubricator and wrench, C. Smith ... 441,074
Axle, railway car, J. A. Mahood ... 441,014
Axle skeins, making, J. Herby ... 441,008
Bag. See Feed bag. Mail bag. Street cleaning bag.
Bailing cotton, H. Rembert ... 441,022
Bailing press, P. K. Dederick ... 440,790, 440,791
Band cutter and feeder, G. H. Lasar ... 440,870
Bar. See Case hardened bar.
Basket, covered, W. Hall ... 441,006
Bearing, anti-friction, L. R. Jewett ... 440,711
Bed bottom spring, G. W. Fishering ... 440,628
Bed, spring, W. A. Yates ... 440,987
Bedstead brace or stay, N. H. Slaughter ... 441,057
Belts upon pulleys, apparatus for replacing, P. J. Holloway ... 440,862
Bench. See Wash bench.
Berths, curtain rod for car, H. H. Sessions ... 440,657
Bicycle, H. S. Danzenbaker ... 440,944
Billiard counters, button for, P. M. De Vitt ... 440,945
Blacking machine, edge, C. F. Leighton ... 441,012
Block. See Ceiling block. Cross cover block.
Board. See Ironing board.
Boards, machine for splitting, surfacing, and matching, E. F. Autenreith ... 440,802
Boiler. See Tubular boiler. Wash boiler.
Book, blank, F. R. Wells ... 440,783
Book cover, M. H. Spear ... 441,114
Book holder, L. W. Noyes ... 440,810
Books, device for securing extra leaves in, J. T. McKean ... 440,841
Boot or shoe tree, Stone & Wellman ... 441,115
Boot tree, J. H. Burbank ... 440,788
Boot tree, A. R. Wellman ... 441,116, 441,117
Bottle filling machine, W. R. Dannals ... 440,946
Bottle stopper, W. H. Page ... 440,649
Box. See Journal box. Letter box. Paper box.
Box making machine, J. Mohs ... 441,104
Box stapling machine, C. Beck ... 441,051
Box trimming machine, E. Diets ... 440,697
Boxes, machine for and process of making, J. Mohs ... 441,105
Brace. See Bedstead brace.
Bracing and securing device, F. W. Shuls ... 440,852
Bracket head and bracket, J. S. Peden ... 440,899
Brake. See Car brake. Wagon brake.
Brake beam, H. B. Robischung ... 440,761
Brush, blacking, B. S. Peck ... 440,844
Buckle, S. Sawyer ... 440,655
Buildings, system for the isolation of, G. C. Anthoni ... 440,938
Bundle carrier, W. R. Baker ... 440,687
Bung extractor, J. B. Sostmann ... 441,113
Burner. See Hydrocarbon burner. Hydrocarbon oil burner.
Burr reamer, W. M. Wood ... 440,682
Button setting machine, G. M. Griswold ... 440,995
Calendar, D. M. Henderson ... 441,067
Camera, F. Nowlan ... 441,018
Car brake, automatic, J. D. Mets ... 441,015
Car coupling, A. Epperson ... 440,626
Car coupling, O. L. Gilbert ... 440,770
Car coupling, D. D. Green ... 440,825
Car coupling, A. A. Moss ... 440,956
Car coupling, G. B. Painter ... 440,746
Car coupling, J. S. Roamer ... 440,652
Car coupling, W. W. Seley ... 440,726
Car, electric railway, W. S. Belding ... 440,689
Car, freight, M. & L. Wetzler ... 440,907
Car heating apparatus, F. P. Foley ... 440,891
Car motor, electric railway, I. F. Baker ... 440,686
Car propulsion, pneumatic street, M. Toulmin ... 440,996
Car, railway, W. S. Bates ... 440,615
Car, railway, K. Upton ... 440,729
Car seal, G. D. Walker ... 440,782
Car table, railway, N. E. Smith ... 440,909
Cars, curtain rod for sleeping, H. H. Sessions ... 440,658
Cars, safeguard for cable and horse, G. Rischmuller ... 440,749
Carbonizing apparatus, Silverberg & Detering ... 440,908
Carrier. See Bundle carrier. Chain carrier.
Carving machine, C. F. Hotchkiss ... 341,087
Case. See Portable case.
Case hardened bar or plate, J. H. Van Dorn ... 440,978
Cash recorder, A. Webster ... 440,670
Caster, A. B. Clark ... 440,875
Casting mould, W. Adams ... 440,801
Cattle, device for pitching up, F. W. Wilder ... 440,676
Ceiling block, D. A. Tompkins ... 440,984
Cereals, preparation of, F. Lauhoff ... 440,869
Chain carrier, endless, M. Swenson ... 440,981
Chair. See Convertible chair. Railway chair.
Check marker, C. H. Cogeshall ... 441,057
Cheese cutter, S. L. Bligh ... 441,053
Chimney cap and ventilator, W. J. Kayser ... 441,101
Chimney cleaner, J. M. Berwig ... 440,940
Chopper. See Stalk chopper.
Chuck, A. Muir ... 441,071
Chuck, G. Wirth, W. S. Sharpneck ... 441,036
Cigar tip cutter and match safe, combined, W. J. Briggs ... 440,874
Cleaner. See Chimney cleaner.
Clevis, plow, J. F. Packer ... 440,648
Clipping machine, wool or hair, W. Silver ... 440,902
Closet. See Dry closet. Water closet.
Clothes line, pinless, E. Converse ... 440,915
Club, policeman's, Underwood & Frese ... 441,045
Clutch, G. Wirth ... 440,679
Coal tar, treating, A. L. Munson ... 440,800
Coffee, apparatus for preparing extract for, H. Barotte ... 440,732
Conductor, underground, E. Verstraete ... 440,780
Conduit, electric, W. J. Brewer ... 440,822
Convertible chair, cradle, and lounge, F. A. Thomas ... 440,974
Copy holder, G. H. Seymour ... 440,907
Copy press, R. A. Brown ... 440,824
Corset, S. Thompson ... 441,077
Cot, folding, C. M. Wagner ... 440,730, 440,732, 440,733
Coupling. See Car coupling. Pipe coupling.
Crib, folding, C. M. Wagner ... 440,731
Cross-over block, F. Bathurst ... 440,753
Crupper former, S. H. Randall ... 440,722
Crushing fork, F. Christenson ... 440,861
Cultivator, S. Brooke ... 440,869
Cultivator and pulverizer, surface, C. C. Crumb ... 440,900
Cup. See Oil cup.
Current generator, pulsating, C. J. Van Depoele ... 440,977
Current fixture, W. C. Howe ... 440,742
Curtain pole and ring, W. H. Lewis, Jr ... 440,773
Cutter. See Band cutter. Cheese cutter. Cigar tip cutter. Feed cutter. Pipe or flue cutter. Stencil cutter.
Darning last, C. H. Shaw ... 440,650
Decorating spherical and uneven surfaces of glass, earthenware, etc., W. J. Dobinson ... 441,086
Digger. See Potato digger.
Disinfecting device, A. B. Upward ... 441,078
Doll hand, M. W. Alderson ... 440,966
Doll head, H. Graeser ... 440,708
Dredging apparatus, hydraulic, H. W. Brown ... 441,055
Drier, J. Bond ... 440,746
Dry closet, Johnson & Kruse ... 440,905
Dye, blue, W. Majert ... 440,965
Dye, blue-black azo, Lauch & Kahn ... 440,839
Edgers, guard for gang, J. Korbel ... 440,828
Eggs, device for use in boiling, J. Verdam ... 440,980
Ejector, L. B. Fulton ... 440,893
Elastic or corded fabric, W. Lapworth ... 440,743
Elastic woven fabric, G. C. Moore ... 440,808, 441,107
Electric collecting device or brush, H. P. Brown ... 440,691
Electric cut-out, Alton & Rice, Jr ... 440,695
Electric machine and motor, dynamo, Andersen & Girdlestone ... 440,908
Electric meter, S. Z. De Ferranti ... 440,627
Electric motor, L. Bock, Jr ... 440,821
Electric motor, C. E. Dressler ... 440,849
Electric motor, H. B. Pullman ... 440,774
Electric motor and generator, C. E. Dressler ... 440,700
Electric motor mechanism, S. E. Mower ... 440,717, 440,718
Electric switch, Baperie & Des Brisay ... 440,614
Electric switch, C. H. Herrick ... 440,845
Electric switch, C. A. Pfluger ... 440,720
Elevator, J. B. Taft ... 440,834
Engine. See Gas engine. Pneumatic engine. Rotary engine.
Engine lubricator, steam, J. T. Case ... 441,066
Engines, bed plate for steam, H. C. White ... 440,674
Engines, mechanism for governing the speed of gas or similar motor, H. Williams ... 441,085
Engines, operating gas, W. Von Oechelhaeuser ... 440,922
Envelope, J. H. Parkhurst ... 440,650
Evaporating pan and furnace for operating the same, W. S. Gilmore ... 441,001
Excavator, J. Cable ... 440,912
Exhibiting device for show windows, etc., E. G. Blake ... 440,991
Explosive, D. Mindeleff ... 440,921
Extractor. See Bung extractor.
Fabric. See Elastic or corded fabric. Elastic woven fabric.
Feed bag, C. A. Bartliff ... 440,785
Feed cutter and corn husker, combined, W. Gutenkunst ... 440,826
Feed cutter and corn husker, combined, A. Rosenthal ... 440,818
Fence, C. R. Price ... 441,072
Fence, B. F. & S. C. Wolfe ... 440,681
Fence post, S. H. Gregg ... 441,004
Fence, wire, S. H. Gregg ... 441,003, 441,005
Fencing stand, W. E. Hathaway *et al* ... 440,832
Fifth wheel, E. P. Gaines ... 440,804
File and binding case, combined letter, W. L. Ohmer ... 440,646
File, bill, T. B. & C. D. Smith ... 440,904
Fire escape tower, F. J. A. Hofman ... 440,827
Fire extinguisher, J. A. Guinn ... 440,640
Fire extinguisher, automatic, J. R. Freeman ... 440,704
Fireplace, C. M. McMahen (r) ... 11,123
Fish trap, C. E. Ketcham ... 441,070
Fishing hook, B. A. Provoost ... 440,721
Fishing rod holder, C. A. Sheafe ... 440,727
Flashing filaments, apparatus for, H. Lemp ... 440,759
Flour, manufacturing, H. Tunie ... 440,975
Flues, machine for cutting, expanding, and beading boiler, A. Vail ... 440,797
Fluid meters, register casing for, C. N. Dutton ... 441,095
Flushing tank for water closets, A. Haarlander ... 441,097
Foretop holder, W. J. Hall ... 440,894
Forgings, apparatus for and method of making rolled, G. F. Simonds ... 440,763
Fork. See Crushing fork.
Fruit brushing machine, Williams & Warner ... 440,667
Furnace door, J. Waters ... 441,083
Furnace grate, M. H. Moskovits (r) ... 11,126
Furnace grate, T. T. Rockett ... 441,023
Gauge, P. Curran ... 440,921
Game, J. H. H. Burge ... 440,737
Game apparatus, C. N. Hoyt ... 441,000
Game apparatus, W. H. Reiff ... 441,080
Gas engine, W. S. Sharpneck ... 441,028
Gas manufacturing apparatus, heating or fuel, A. Kitson ... 440,950
Gas, manufacturing illuminating, E. De Beauharnais ... 440,754
Gate. See Automatic gate. Railway gate. Swinging gate. Wagon gate.
Gate, W. T. Fe Britton ... 440,902
Gate, T. E. Coffin ... 440,620
Generator. See Current generator.
Gold wire, seamless compound, L. L. Burdon ... 440,688
Governor, gas engine, W. S. Sharpneck ... 441,075
Grater, F. A. Schaetzke ... 440,901
Gravity scalper, F. Noble ... 440,882
Grindstones, cleaning the faces of, E. J. Bonett ... 440,616
Guitar, R. Lorang *et al* ... 440,962
Gun lock, E. H. Decker ... 440,939
Gun, spring air, A. B. Kleaber ... 440,638
Guns, small lock for bolts of breech-loading, P. Mauser ... 440,965
Hammer and box opener combined, folding, R. Steinecke ... 440,908
Hams, etc., fastening device for, C. Maisel ... 440,815
Handle. See Tool handle.
Harrow, E. J. Travis ... 440,854
Harrow, disk, E. C. Boyer ... 441,054
Harrow, revolving, G. C. Billups ... 440,846
Harvester, A. O. Slents ... 441,058
Harvester, grain binding, A. O. Slents ... 441,059
Harvester, self-binding, C. H. Saltman ... 441,110
Hatchet for shingling, B. C. Pettingell ... 440,962
Hinge for flasks, etc., A. Schiefer ... 440,724
Hitching strap for double teams, Budd & Sands ... 440,940
Hogshead making machine, K. E. King ... 441,011
Holder. See Book holder. Copy holder. Fishing rod holder. Foretop holder. Nipple holder. Paper holder. Thread holder
Hook. See Fishing hook.
Hoop for coopers' ware, L. L. Frost ... 440,969
Horse shield, N. E. Springsteen ... 440,897
Hose, apparatus for making seamless rubber lined, E. N. Foote ... 440,703
Hose connection, J. G. Hallas ... 440,844
Hose reel, R. S. Chapman ... 440,858
Hydrocarbon burner, C. M. Gearing ... 441,002
Hydrocarbon oil burner, C. E. Burbank ... 440,942
Hydrogen peroxide, making, W. Erwin ... 440,792
Indicating mechanism, coin-operated, W. R. Smith ... 440,728
Indicator. See Mail indicator.
Inhaler, Krohne & Sesemann ... 440,713
Injector, A. S. Eberman ... 440,624
Inking appliance, W. G. Fuerth ... 440,824
Iron ores, reducing, Lash & Johnson ... 441,102
Ironing board, S. J. Talbot ... 440,972
Jack. See Wagon jack.
Joint. See Rail joint. Steam joint.
Journal box, anti-friction, W. S. Sharpneck ... 441,027
Knife. See Paper trimming knife.
Knife cleaning and polishing machine, T. A. Evans ... 440,948
Knitting machine, circular, F. A. Nye ... 440,809
Knitting machine, straight fashioning, Sleeper & Miller ... 440,903
Lamp, electric arc, Thomson & Rice ... 440,662, 440,663
Lamp extinguisher, F. Rhind ... 440,748
Lamp, oil, Berry & Fell ... 441,052
Lamp socket, incandescent electric, J. W. Collier ... 441,060
Lamps and lanterns, burner fastening for tubular, C. Lapierre ... 440,898
Lamps, wick raising mechanism for, G. W. Woodward ... 440,683
Latch, gate, A. C. Hendricks ... 440,919
Leather dressing, J. W. Jolly ... 441,010
Letter box, W. L. Godfrey ... 441,093
Lever for moving locomotives or cars, W. H. Garlock ... 441,061
Life-saving apparatus, stationary, M. Waldner ... 441,082
Lightning arrester, E. W. Rice, Jr ... 440,654
Line check, T. H. Price ... 440,897
Lock. See Gun lock. Nut lock. Velocipede lock.
Lock, H. O. Hooper ... 440,846
Locomotive smoke box front plate, W. R. Stirling ... 440,929
Logging skid, W. J. Ackerman ... 441,047
Loom, Sawyer & Lahue ... 440,854
Loom for weaving velvets, etc., F. H. Wilke ... 441,084
Loom, lapper, J. W. Cheney ... 440,943
Lubricator. See Axle lubricator. Engine lubricator.
Mail bag, C. P. Tatro ... 440,932
Mail indicator and advertising board, T. B. Peacock ... 440,861
Malt turning apparatus, J. A. Saladin ... 440,850
Mains signal, F. E. Forster ... 440,741
Mask, complexion, N. E. Jenkins ... 441,009
Match boxes with matches, apparatus for filling, N. M. Strom ... 440,930
Matrix making machine, C. L. Bedfield ... 441,118
Matting machine, A. T. Brown ... 440,909
Meat tenderer, S. C. Hunter ... 440,909
Mechanical movement, C. D. Sigsbee ... 441,112
Medicine, stomach bitters, H. W. Farrell ... 440,886
Metallic plate work, raising and forming machine for, R. B. Swain ... 440,888
Meter. See Electric meter.
Mill. See Pug mill. Rolling mill.
Mould. See Anvil mould. Casting mould.
Mould, E. W. Johnson ... 440,810
Mortar mixing machine, J. H. Parkhurst ... 440,651
Motion transmitting device, B. F. Sammons ... 440,851
Motor. See Car motor. Electric motor. Spring motor.
Motor, G. H. Chappell ... 440,943
Mowing machine, J. W. James ... 441,089
Musical instrument, stringed, G. W. Van Dusen ... 440,979
Musical instruments, keyboard attachment for, C. De Vilbiss ... 440,905
Musicians, exercising device for, E. S. Bonelli ... 440,877
Nailing machine, L. Goddu ... 440,905
Nailing mouldings in panels, device for, J. N. Hibbard ... 440,808
Nipple holder, D. A. Holland ... 441,007
Nozzle sprayer, Bacon & Holsinger ... 440,048
Nut lock, A. A. Dickie ... 440,749
Oil cup, W. M. Herrick ... 440,771
Oil mills, separator for cotton seed, M. Wallace ... 440,981
Ordnance, breech mechanism and attachment for, S. H. Emmens ... 440,625
Ore, magnetically concentrating, G. Conkling ... 441,061
Oven, A. S. Cox ... 440,840
Overalls, I. M. Appel ... 440,966, 440,980
Oxygen, obtaining, F. Salomon ... 440,777
Pail bottom, Lisk & Van Auken ... 440,642
Paint, J. Smith ... 441,075
Pan. See Evaporating pan.
Paper box, F. G. Hotchkiss ... 440,756
Paper box, Sefton & Ferree ... 440,654
Paper holder and cutter, roll, W. A. Schenck ... 440,926
Paper pail, W. E. Montgomery ... 440,643
Paper, toilet, E. Jerome ... 440,828
Paper trimming knife, L. P. Jackson ... 440,879
Paper macne matrix drying apparatus, J. W. Osborne ... 440,923
Parer and corer, vegetable, P. T. Gates ... 440,705
Pen, S. W. Robinson ... 440,723
Pen feeder, fountain, E. S. Johnson ... 440,712
Pen, fountain, L. A. Shattuck ... 441,111
Pencil sharpener, A. J. Mundy ... 441,016

Perforating paper patterns, machine for, G. W. Weiss 440,799
Photographic apparatus, pocket, A. Goldschmid.. 441,054
Pies, composition for protecting, J. Rowe 440,832
Pipe coupling, double, T. W. Moran 441,108
Pipe or flue cutter, J. Warren 440,962
Pipe wrench, A. A. Peterkin 441,020
Plant setting machine, N. M. Chew 440,738
Planter and marker, corn, J. De Butts 440,917
Planter, corn, W. H. Benford 441,001
Planter, cotton, B. Bowers 440,782
Planters, drop regulating attachment for seed, R. K. Braker 440,736
Plating metal, G. V. Meyer 440,847
Plow, gang, G. W. Rife 440,900
Plow, wheel, G. Moore 440,574
Plows, helm for, J. F. Packer 440,647
Plumbers' traps, making, G. W. Knapp 440,951
Pneumatic engine, H. W. Metsing 441,104
Portable case for fragile articles, H. Hausemann. 440,680
Post. See Fence post.
Potato digger, W. R. Wheeler 440,673
Power, system of electrical transmission of, C. J. Van Depoele 440,976
Power transmitting mechanism, W. S. Belding.... 440,988
Press. See Baling press. Copy press.
Printing apparatus, manifold, W. H. Folsom 440,802
Printing woven fabrics, machine for, J. Shinn.... 440,750
Prison door mechanism, J. H. Van Dorn 441,059
Propelling and steering boats, apparatus for, H. Barcroft 441,049
Propelling and steering vessels, apparatus for, H. Barcroft 441,050
Projectiles for firearms and ordnance, D. B. Wesson 440,672
Protector. See Thermal protector. Watch protector.
Pug mill, P. Stenger 440,971
Pump, centrifugal, S. E. Webbe 440,708
Pump, steam and vacuum, G. E. Nye 440,719
Punch, ticket, A. W. Coffin 440,739
Push button, H. Von Kohler 440,814
Rack. See Show rack.
Radiator ventilator, H. L. Reed 440,964
Rail joint, Dube & Messier 440,623
Railway cable crossing, P. Somerville 441,060
Railway chair, G. W. Bittersbach 441,109
Railway construction, Schmidt & Silsbee 440,725
Railway, electric, S. Trott 440,906
Railway gate, W. D. Sheldon 441,052
Railway rail, M. A. Glynn 441,002
Railway signal, J. W. Riggs 440,925
Railway signal, electric, W. H. Waddell 441,044
Railway signaling apparatus, electric, F. F. Loomis 440,881
Railway signaling device, J. W. Riggs 440,926
Railway signaling system, J. W. Riggs 440,927
Railway sleeper, Ewing & Bockus 440,897
Railway switch, J. W. Norton 440,793
Railway switch operating device, W. W. Le Seur. 440,840
Railway tie, J. Reifert 440,653
Railway time signal, Coolbaugh & Hooper 440,800
Railway track rails, apparatus for blowing sand from, J. F. Bevin 440,640
Railway train signal, W. D. Sheldon 441,030, 441,053
Railways, lightning, W. D. Sheldon 441,054
Railways, overhead conductor for electric, R. D. Cushing 440,789
Railways, trolley arm for electric, E. Thomson.... 440,905
Railways, trolley for electric, C. A. Lieb 440,814
Railways, trolley or plow for electric, E. Verstraete 440,731
Ramie and other fibrous materials, machine for disintegrating, E. Marc 440,775
Ranges, water heating attachment for, H. C. Steinhoff 440,970
Recorder. See Cash recorder.
Reduplicating apparatus, W. G. Fuerth 440,736
Reel. See Hose reel.
Refrigerating and heating pipes, disk for, P. Weisel 440,671
Resilient spiral washer, H. A. Harvey 440,681
Retort charging apparatus, F. Bredel 440,617
Rock drilling machine, E. Moreau 440,745
Rod mill plant, L. A. Kilmer 440,803
Roller mill feeder, L. Lash 440,930
Rolling mill, F. H. Daniels 440,626
Roofing and isolating material, A. Siebel 441,056
Rotary engine, Worley & Davis 440,858
Rumble, Angell & Taylor 440,820
Safe door, G. L. Damon 440,795
Salt, purifying, E. K. Mitting (r) 11,125
Sash balances, W. & S. Orbeton 441,019
Sash fastener, J. Wood 440,809
Sash stop, window, E. T. Early 440,947
Saw gin, W. Deering 440,918
Saw set, C. Huntsman 441,100
Scale beam for grain weighers, Cooley & Richards 440,740
Scales and desk ruler combined, paper weighing, P. A. O'Marra 440,969
Screen. See Window screen. Window and door screen.
Screw blanks, etc., machinery for reducing the diameter and for tapering, J. Sheldon 441,073
Seed feeding machine, D. A. Tompkins 440,945
Separator machine, N. W. Holt 440,654
Sewing machine attachment, M. E. Tynes 440,955
Sewing machine, buttonhole, T. E. Colby 441,056
Sewing machine buttonhole cutting mechanism, W. Raeuchle 440,760
Sewing machine feeding mechanism, P. Diehl 440,630
Sewing machine ruffling device, M. G. Turner.... 440,956
Shade and curtain pole, window, R. A. Battee.... 440,906
Shears, etc., device for sharpening, W. E. Woodruff 440,985
Shears for dehorning animals, J. D. Green 441,005
Shoe fastening, J. D. Griffen 440,806, 440,807
Shoes, manufacture of, G. W. Day 440,904
Shovel, J. Telfer, Jr 440,933
Show rack, L. D. Freeman 440,629
Sifter, ash, J. K. Russell 440,906
Signal. See Marine signal. Railway signal. Railway time signal. Railway train signal. Train signal.
Singletree support, R. C. Allen 440,987
Sleeve draughting apparatus, adjustable, F. E. Buddington 440,990
Slicing or chopping machine, J. Wratil 441,081
Speaking tubes, mouthpiece for, W. H. Ross 440,980
Speed governor for gas engines, W. S. Sharpneck. 441,024
Spinning or twisting machines, yarn separator for, F. Cranska 440,841
Spinning spindle winder, E. Gessner 441,010
Spool making machine, J. H. Ansell 440,734
Spreader attachment, P. Keene 440,637
Spring. See Bed bottom spring.
Spring motor, F. Briggs 440,873
Stalk chopper, R. H. Tisdale 440,978
Stamp canceling and dating machine, S. B. Whiteside 440,975
Stamp delivery machine, coin-controlled, S. M. & C. O. Dowst 440,798
Steam joint, universal, H. T. Knight 440,804
Steam, precipitator for impurities in exhaust, C. A. Macdonald 440,715
Stencil cutter, J. F. Wickman 440,955
Stopper. See Bottle stopper.
Store service apparatus, J. T. Cowley 440,795
Stove, heating, Moore & McKim 440,716
Stove or range door opening and closing mechanism, C. H. Miller 440,848
Strainer and drip retainer, tea pot, J. O. Draper . 440,842
Strap. See Hitching strap.
Street cleaning bag and shovel, combined, M. G. Byers 440,618
Striking or hammering mechanism, E. Moreau.... 440,744
Sugar, apparatus for producing white, C. Steffen.. 441,076
Swinging gate, C. M. Clark 440,619
Switch. See Electric switch. Railway switch.
Table. See Car table.
Tank. See Flushing tank.
Tapping mains, machine for, E. J. Wisehaupt.... 440,856
Telegraphy, P. B. Delany 440,796
Telegraphy, multiplex, P. B. Delany 440,798
Telegraphy, synchronous, P. B. Delany 440,797
Telephone lines, calling device for clock, J. A. McManman 440,898
Terra cotta construction, J. Lynch 441,013
Thermal protector, H. V. Hayes 441,096
Thresher and cleaner, traveling, G. W. Haines.... 440,843
Thrashing machine attachment, D. Wilde 440,751
Thread holder, J. Keats 440,812
Tie. See Railway tie.
Tire and rim, wheel, S. Elliott 440,701, 440,702
Toner, pipe, W. O. Nightengale 441,017
Tool handle, J. Swan 440,705
Torch and hand warming cans, combined, J. A. Nesmith 440,849
Train signal, W. D. Sheldon 441,031
Tramway carriage, G. H. Hulett 440,809
Transporting receptacle, Rogers & Hofman 440,885
Trap. See Fish trap.
Trimming, S. Finkelstein 440,856
Truck, car, W. C. Nason 440,645
Trunk fastening, M. C. Hutton 440,656
Trunk, wardrobe, S. M. McCormack 440,957
Tubular boiler, N. S. & E. E. Bowdish 440,872
Tuft, Hutchinson & Cables 440,710
Tufts or buttons, machine for making, Hutchinson & Cables 440,708
Typewriting machine, A. C. Harbout 441,098
Vacuum chamber, J. Patten 440,787
Valve, balanced cut-off, J. T. Case 441,092
Valve, gas engine, W. S. Sharpneck 441,023
Valve gear, A. P. Trues 440,706
Valve, lock, Lamb & Crowell 440,714
Valve, steam engine, H. N. Gale 440,757
Valve, steam engine, J. Goss 440,995
Vaporization of liquids, apparatus for the, M. M. Montanto 441,106
Vault or like structure, safety, G. S. Clark 440,914
Vehicle running gear, C. A. Behlen 440,851
Vehicle running gear, J. W. Heeney 440,707
Vehicle running gear, J. W. Leete 440,807
Vehicle running gear, J. W. Patterson 440,960
Vehicle running gear, L. W. Sharpe 440,778
Vehicle running gear, R. F. Vaughan 440,819
Vehicle sand band, J. Cable 440,911
Velocipede, E. G. Latta 440,897
Velocipede, F. Martin 440,954
Velocipede lock, G. R. Fuller 440,947
Vending apparatus, J. A. Williams 440,983, 440,984
Ventilator. See Radiator ventilator.
Volumetric values, mechanism for recording, C. N. Dutton 441,094
Wagon brake, J. B. Hutchinson 441,008
Wagon, dumping, S. S. Whitmore 440,906
Wagon gate, automatic, C. W. Thompson 440,953
Wagon jack, R. H. Wilson 440,678
Wagon step, R. K. Thompson 440,951
Walking, running, and jumping, apparatus for facilitating, N. Yarn 440,984
Wall ornament, M. E. Conegan 440,764
Wash bench, J. McLain 440,956
Wash boiler, G. Bowler 440,941
Wash boiler, A. C. Smith 440,940
Washer. See Resilient spiral washer.
Washer, J. A. Turnbull 440,870
Washing machine, J. H. Lowrey 440,774
Watch protector, C. C. Wright 441,046
Watch, stem winding and setting, C. T. Higginbotham 440,875
Watches, hair spring stud for, C. T. Higginbotham 440,877
Water, apparatus for utilizing natural gas for raising, W. H. & S. B. Castor 441,056
Water closet, H. H. Craigie 440,756
Water closet, P. White 441,045
Wax, composition for shoemaker's, E. Rocho 440,702
Weather strip, Withers & Knobel 440,807
Weighing machine, grain, C. H. Phillips 440,734
Welding apparatus, electric, H. Lemp 440,941
Welding compound, F. Durrant 440,946
Welding, electric, E. Thompson 440,664
Welding transformer, electric, H. Lemp 440,840
Well drilling machine, G. Pech 440,934
Wheel. See Fifth wheel. Wind wheel.
Wheel, E. E. A. Sorel 441,041
Wick raiser, H. L. Clark 440,730
Wind wheel, J. W. Vincent et al 440,993
Winding thread, apparatus for, J. Kesta 440,811
Windlasses, locking gear for, E. H. Whitney 440,784
Windmill, W. E. Shields 441,035
Window or door screen, adjustable hinged, W. H. Grubb 441,006
Window screen, T. Smith 441,038
Wire drawing machine, G. Wirth 440,680
Wire rope machine, W. R. Beckmann 440,850
Wire, seamless plated hollow, L. L. Burdon 440,624
Wire system, underground, E. Verstraete 441,043
Wood and other compressible material, machine for ornamenting, E. W. Alleigh (r) 11,121
Wood and other compressible material, two-part cylinder and die for ornamenting, E. W. Alleigh (r) 11,122
Woodworking machines, feeding attachment for, E. Benjamin 440,735
Wool, apparatus for extracting grease from, L. Pinagel 440,963
Wrench. See Pipe wrench.
Wrench, A. Chainey 440,889
Yeast, preparing, E. Lecomte 440,772
Yoke and brush holder, F. B. Rae 440,837

DESIGNS.

Album cover or case, Pattberg & Brodhag 20,343
Barber's chair, H. A. Schneekloth 20,344
Brush back and handle, J. F. Whitney 20,345
Carpet, J. L. Folsom ..... 20,301 to 20,314
Carpet, O. Hedtke 20,314, 20,315
Carpet, H. Hunt 20,316
Flower pot, J. G. Whilldin ..... 20,336 to 20,337
Handle for spoons, forks, etc., B. Lodine 20,338, 20,339
Knife, G. W. Steding 20,334
Knurling tool, C. Shaefer 20,317
Magnet, E. Weston 20,318
Organ case, L. K. Fuller 20,342
Spoon, soup, N. A. Wheeler 20,340
Stove, cooking, Bascom & Ritchie 20,419
Stove, heating, Bascom & Ritchie 20,320
Table knife, A. W. Cox 20,341
Wall paper, C. Boose ..... 20,321 to 20,333
Water closets, seat plate for, J. Reid 20,346

TRADE MARKS.

Anti-febriles, Farbenfabriken, vormals Fr. Bayer & Co 18,627
Cure for catarrh and lung and liver troubles, Tomlinson Dead Shot and Quick Relief Oil Co 18,628
Coffee, A. Roth Grocery Company 18,640
Flour, wheat, C. A. Gambrill Manufacturing Company 18,638
Flour, wheat, A. V. Ryder 18,639
Gum, candy, and other confections, chewing, H. D. Smith & Co 18,623
Gum, chewing, C. S. Burroughs 18,641
Lighting machinery, incandescent, National Electric Manufacturing Company 18,645
Liquid drier, C. H. Gillespie & Sons 18,632
Medical belt for the cure of disease, G. W. Angell. 18,626
Medicine for diseases of the liver and for chills, A. C. Simmons, Jr., Medicine Company 18,624
Ozone water, Ozone Manufacturing Co 18,633
Paper, writing and book, Whiting Paper Company. 18,635
Silks, raw, Bavier & Co ..... 18,628 to 18,631
Stove polish, H. W. Weeks 18,634
Watch cases, Metropolitan Watch Company 18,644
Water closets, T. G. Knight 18,614
Whisky, Edel Brothers 18,636
Whisky, F. Goetzmann & Co 18,642
Woods, dyed and stained, Aaffermann & Co 18,627

A Printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated, the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

USE ADAMANT WALL PLASTER

It is Hard, Dense, and Adhesive. Does not *check or crack.* It is impervious to wind, water, and disease germs. It dries in a few hours. It can be applied in any kind of weather. It is in general use. Licenses granted for the mixing, using, and selling.

Address ADAMANT MFG. CO. 309 E. Genesee St., Syracuse, N. Y.

"Star" Foot Lathe Swings 9x25 in.
Screw Cutting Automatic Cross Feed, etc.
LATHE
Scroll Saws, Circular Saws, Lathes, Mortisers.
Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 695 Water St., Seneca Falls, N. Y.

THE GREAT WRITERS OF THE DAY

To convince everybody, before subscribing, of the high quality and interest of our **Beautifully Illustrated** journal in its new form, we will send to any address

Three Weeks for 10 cents

SEND TEN CENTS for a trial subscription, and we will send you three numbers, including our CHRISTMAS NUMBER, with an artistic cover; also, our Calendar Announcement for 1891, with a painting—"The Minuet"—by J. G. L. Ferris.

These three numbers contain the following reading-matter:

(1) **Mrs. Amelia E. Barr's** new serial, "The Beads of Tasmer." Mrs. Barr is the author of that most successful serial, "Friend Olivia," just completed in *The Century;* but hereafter Mrs. Barr will write exclusively for *The New York Ledger.*

(2) **Hon. George Bancroft's** description of "The Battle of Lake Erie," beautifully illustrated.

(3) **Margaret Deland's** latest story. "To What End?"

(4) **James Russell Lowell's** poem, "My Brook," written expressly for *The Ledger,* beautifully illustrated by Wilson de Meza, and issued as a FOUR-PAGE SOUVENIR SUPPLEMENT.

(5) **Mrs. Dr. Julia Holmes Smith** starts a series of articles giving very valuable information to young mothers.

(6) **Robert Grant's** entertaining society novel, "Mrs. Harold Stagg."

(7) **Harriet Prescott Spofford, Marion Harland, Marquise Lanza, Maurice Thompson,** and **George Frederic Parsons** contribute short stories.

(8) **James Parton, M. W. Hazeltine** and **Oliver Dyer** (author of "Great Senators") contribute articles of interest.

In addition to the above, SPARKLING EDITORIALS, Illustrated Poems, HELEN MARSHALL NORTH'S chatty column, and a variety of delightful reading of interest to all members of the household.

The foregoing is a sample of the matter which goes to make up the most perfect National Family Journal ever offered to the American people.

Send Ten Cents for these three numbers and judge for yourself, or send only Two Dollars for a year's subscription to

THE NEW YORK LEDGER,

Robert Bonner's Sons, Publishers, 21 William St., N. Y. City.

The Sebastian-May Co.
Improved Screw Cutting Foot & Power **LATHES**

Drill Presses, Chucks, Drills, Dogs, and Machinists' and Amateurs' Outfits. *Lathes on trial.* Catalogues mailed on application.
165 to 167 Highland Ave., SIDNEY, OHIO.

CATALOGUES FREE TO ANY ADDRESS OF
GEARS AND PARTS OF MODELS
GOODNOW & WIGHTMAN
BOSTON

$3 PRINTING PRESS. Do all your own printing. Save money. Catalogue for two stamps. Kelsey & Co., Meriden, Conn.

ROCK DRILLS
AIR COMPRESSORS,
MINING AND QUARRYING MACHINERY,
Ingersoll-Sergeant Rock Drill Co.
No. 10 PARK PLACE, NEW YORK.
Send for Complete Priced Catalogue.

WELLS LIGHT
WELLWORK & WELLS' PATENTS.
2000 CANDLE POWER LIGHT
FOR FOUNDRIES, IRON BOILER SHOPS, WORKS AND OTHER PLACES REQUIRING A POWERFUL LIGHT
KEEGAN & HALPIN 44-46 WASHINGTON ST. N.Y.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

ROCK DRILLS
AIR COMPRESSORS &
GENERAL MACHINERY FOR
MINING, TUNNELING,
QUARRY & RAILROAD WORK
RAND DRILL Co 23 PARK PLACE N.Y.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page, or address MUNN & CO., Publishers, 361 Broadway, New York.

Edwards' Works on the Steam Engine

The American Steam Engineer. Theoretical and Practical: with Examples of the Latest and Most Approved American Practice in the Design and Construction of Steam Engines and Boilers of Every Description. For the use of Engineers, Machinists, Boiler Makers, and Students. By Emory Edwards, M.E. Illustrated by 77 engravings. 12mo, 419 pages **$2.50**

Modern American Marine Engines, Boilers, and Screw Propellers. Their Design and Construction. Showing the Present Practice of the most Eminent Engineers and Marine Engine Builders in the United States. By Emory Edwards. Illustrated by 30 large and elaborate plates. 4to **$5.00**

The Practical Steam Engineers' Guide in the Design, Construction and Management of American Stationary, Portable, and Steam Fire Engines, Steam Pumps, Boilers, Injectors, Governors, Indicators, Pistons and Rings, Safety Valves and Steam Gauges. For the use of Engineers, Firemen, and Steam Users. Illustrated by 119 engravings. 420 pages, 12mo.....**$2.50**

A Catechism of the Marine Steam Engine. For the use of Engineers, Firemen, and Mechanics. A Practical Work for Practical Men. Illustrated by 66 engravings, including examples of the most modern engines. Fifth edition, thoroughly revised, with much new matter. 12mo, 414 pages..... .....**$2.00**

Modern American Locomotive Engines. Their Design, Construction, and Management. Illustrated by 78 engravings. 12mo, 223 pages **$2.00**

☞ *The above or any of our Books sent by mail, free of postage, at the publication prices, to any address in the world.*

☞ *Illustrated circulars, showing full tables of contents of all of the above valuable books, will be sent free to any one in any part of the world who will send his address.*

☞ *Our New and Revised Catalogue of Practical and Scientific Books, 84 pages, 8vo, as well as our other catalogues and circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

OUR MAGIC LANTERNS WITH OIL LAMPS HAVE NO EQUAL. **VIEWS** OF ALL SUBJECTS. EASTERN PRICES GUARANTEED. SEND FOR CATALOGUE OF **L. MANASSE** 88 MADISON ST. CHICAGO ILL.

HOME-MADE INCUBATOR.—PRACTICAL directions for the manufacture of an effective incubator that has been carefully tested and found to perform all that may be reasonably expected; with directions for operating. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **630**. Price 10 cents. To be had at this office and from all newsdealers.

The CHANDLER WATER MOTOR

Works well on **Low** and **High** Pressures.

Single, Duplex, Triple, and Quadruple Automatic **PISTON MOTORS**, *adapted to all classes of work.*

Send for Circulars.

WM. H. LOCK, Buffalo, N. Y.

HOW TO MAKE DYNAMO-ELECTRIC Machines.—By Geo. M. Hopkins. With drawings to scale and full directions for constructing dynamos of different sizes. The small machine is intended for experimental purposes. Will heat from 4 to 6 inches of platinum wire, produce the electric light, decompose water rapidly, magnetize steel, ring a large gong, give powerful shocks, operate induction coils, and will, for temporary use, replace 8 or 10 Bunsen cells. Contained in SUPPLEMENTS **161** and **599**. Price 10 cents each. The larger machine produces eight 16-candle lights or one powerful arc light. Can be arranged as a series, shunt, or compound wound machine. Can be run for a short time by two or four men. Requires one horse power for continued running. Best engravings of dynamo ever produced. Details of every part shown. Winding of armature and field magnet plainly illustrated. Any intelligent person with the aid of these drawings and instructions may make useful, durable, and effective machines. Contained in SUPPLEMENT **600**. Price 10 cents. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

Watchman's Improved Time Detector with Safety Lock attachment. Patented 1875-6-7-80-81. Beware of infringements. This instrument is supplied with 12 keys for 12 stations. Invaluable for all concerns employing night watchmen. Send for circulars to E. IHAUSER, P. O. Box 2875. 206 B'way New York.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632**. Price 10 cents. To be had at this office and from all newsdealers.

THE EAGLE
THE EASIEST RUNNING BICYCLE IN THE WORLD.
☞ Speed, Comfort and Safety.
AGENTS WANTED.
Large Illustrated Catalogue sent Free to any Address.
THE EAGLE BICYCLE MFG. CO.,
STAMFORD, CONN.

Patente.

An deutsche Erfinder.

Die grosse und thätige Klasse der deutschen Erfinder in den Verdnigten Staaten machen wir besonders darauf aufmerksam, dass unsere Firma durch ihre Verbindungen mit Washington und den europäischen Hauptstädten, besondere Vortheile zur Erlangung von in- und ausländischen Patenten bietet.

Jeder Erfinder, gleichviel welcher Nationalität angehörig, ist durch die liberalen Patentgesetze der Vereinigten Staaten zum Patentschutz für Erfindungen berechtigt.

Unsere Firma ist bereit, gestützt auf eine 45 jährige Erfahrung, deutsche Erfinder jeder Zeit zu berathen und ihnen behülflich zu sein zu mässigen Preisen rasch und pünktlich Patente zu erlangen.

Unsere deutsche Abtheilung wird von fähigen deutschen Ingenieuren geleitet welche in der Office mit persönlich vorsprechenden Erfindern direkt verkehren, und Rath und Auskunft geben. — Unsere weitbekannte und populär gehaltene Zeitschrift der "Scientific American" bespricht in ihren Spalten die bedeutenderen Erfindungen der Neuzeit. Eine kurze Beschreibung von Erfindungen, die durch uns patentirt werden, geben wir unentgeltlich in unserer Zeitschrift.

Correspondenz in deutscher Sprache erbeten.

Pamphlet, in deutscher Sprache, über Patente wird auf Verlangen frei zugeschickt.

Man adressire:

MUNN & CO.,
361 Broadway New York.

TYPEWRITERS.

ALL MAKES. NEW & SECOND HAND BOUGHT, SOLD AND EXCHANGED. ALSO RENTED ANYWHERE IN U.S. GET OUR PRICES BEFORE BUYING. NEW CATALOGUE ON APPLICATION.
NATIONAL TYPEWRITER EXCHANGE, 200 LA SALLE ST. CHICAGO

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116**. Price 10 cents. To be had at this office and of all newsdealers.

CLARK'S
Ventilating and Drying
FANS.
Light Running, Adjustable Blades, Self-Oiling Bearings. 24-page catalogue free. Also Rubber Press Rolls for Wool and Yarn Washing and Dyeing Machines.
GEO. P. CLARK, Manuf.
Box L, Windsor Locks, Ct.

CROSBY POP SAFETY VALVE
WATER RELIEF VALVE
IMPROVED STEAM GAGE
STEAM ENGINE INDICATOR
Single Bell Chime Whistle, and all instruments used in connection with Steam, Air and Water.
Sole Agents for Clark's Lamen Fire Hose.
NEW YORK, LONDON.
CROSBY STEAM GAGE & VALVE CO. 93 Oliver St. Boston, Mass.

2nd **MACHINERY** List sent.
N. Y. Mach'y Depot, Bridge Store 16. Frankfort St., N.Y.

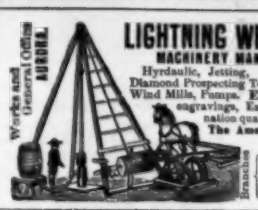
ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641**. Price 10 cents. To be had at this office and from all newsdealers.

STEVENS PATENT FIRM JOINT HERMAPHRODITE CALIPERS
No. 56 E. Price List.—Sent by mail.

3 inch.....	$0.35	6 inch.....	$0.65	10 inch.....	$0.85
4 "	0.45	8 "	0.75	12 "	1.00
5 "	0.55				

Ideal and Leader Spring Dividers and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 280, Chicopee Falls, Mass.

Cheap Printing Do it yourself. Circular press $8. Size for small newspaper, $44. Everything easy, printed rules. Send two stamps for Catalogue to factory. **KELSEY & CO., Meriden, Conn.**



LIGHTNING WELL-SINKING MACHINERY MANUFACTURERS.
Hydraulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. **Encyclopedia,** 1,000 engravings, Earth's Strata, Determination quality water; mailed, 25c.
The American Well Works,
Aurora, Ill.
Branches: 11 & 12 S. Canal St., Chicago, Ill. 1112 Elm St., Dallas, Texas.

OIL WELL SUPPLY CO. Ltd.
91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for **ARTESIAN WELLS** for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.

ARTESIAN
Wells. Oil and Gas Wells, drilled by contract to any depth, from 500 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. **Pierce Artesian and Oil Well Supply Co.,** 80 Beaver Street, New York.

Portable GASOLINE Engines
For Threshing Machines, Hay Presses, Corn Shellers, Pile Drivers, Well Diggers, &c., our newest and latest Engine a little wonder and a *giant to work.*
Send for prices. Mention this paper.
Van Duzen Gas & Gasoline Engine Co.
CINCINNATI, OHIO.

THE PENNA. DIAMOND DRILL & MFG. CO. BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.

Something New. Strange's Patent Combination Vise and Drill. Before you buy a vise, send for circular and price list. Address STRANGE'S MACHINE WORKS, TAUNTON, MASS., U. S. A.

PULLEYS HANGERS, FRICTION CLUTCHES. PROGRESS MACHINE WORKS, A. & F. BROWN, 44 Park Place, N. Y.

NATIONAL STEEL TUBE CLEANER

RANKS THE HIGHEST
Endorsed by the best Engineers.
CHALMERS-SPENCE CO.
Office, 59 Liberty Street.
Works, 419-425 E. Eighth St., New York

A LIBRARY FOR $1.00

Five books in one. Worth its weight in gold to every mechanic. The very latest information for 20 different trades. This wonderful book contains 575 pages absolutely teeming with rules, tables, secret processes, and new information that cannot be had elsewhere for less than $25.00. The Modern Steam Engine—How to Read an Indicator—The Westinghouse Air Brake—Blacksmith's and Machinist's Tools—Practical Mathematics Simplified—Tin and Sheet Iron Worker's Manual—Carpenter's Manual—Points for Painters—Magnetism and Electricity—How to Get a Patent—A Mechanical Dictionary. Everything fully explained in one handsome volume and guaranteed to be absolutely correct. Send $1.00 for a copy bound in silk cloth, or $1.50 for Morocco binding. With each copy of the book we give free a complete working chart for setting gear teeth. The regular price of this chart is $1.50. AGENTS WANTED. Write for terms. LAIRD & LEE, Publishers, 203 Jackson Street, Chicago, Ill.

MONON ROUTE The tourist route between Chicago and Southern Winter resorts via Indianapolis and Cincinnati. Lafayette or Louisville. For particulars, address JAMES BARKER, Gen. Pass. Agt., Monon Block, Chicago

DEAFNESS & HEAD NOISES CURED by Peck's INVISIBLE TUBULAR EAR CUSHIONS. Whispers heard. Comfortable. Successful where all Remedies FAIL. Ills. book & proofs free. Address F. HISCOX, 853 Broadway, New York.

Astronomical Telescopes of superior defining power.
EYE PIECES, etc.
Manufactured by
W. & D. MOGEY,
418 West 27th Street, New York.
Send for catalogue.

U. S. Engineer Office, Room 63, Army Building, New York, October 29, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock noon, Monday, December 1, 1890, for the delivery at Sandy Hook, N. J., of 41,000 cubic yards of broken stone (granite, trap, or limestone) and 62,000 barrels of Rosendale cement. The attention of bidders is invited to Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, vol. 23, p. 332, and vol. 24, p. 414, Statutes at Large. For full information, apply to G. L. GILLESPIE, *Lieut. Col. of Engineers.*

$10 CASH An investment of this amount and $5 per month will realize to the purchaser 100 per cent. within two years. One of the best suburban properties in Tacoma, Wash., on the line of street railway connecting two flourishing cities. Price of lots, $100; corner lots, $125. Write for maps and particulars. A liberal concession made to parties buying in large quantities for cash. Reference, Washington National Bank. E. N. OUIMETTE, 1316 Pacific Ave., Tacoma, Washington.

Barnes' New Sensitive Drill
Has These Great Advantages:
The speed of the drill spindle can be **Increased** or **Diminished Instantly,** or the motion reversed, without **stopping** the **machine** or **shifting belts.** More or less driving power can be applied to the drill spindle, as the size of the drill or the nature of the work may demand.
W. F. & JNO. BARNES CO.,
1999 Ruby St., Rockford, Ill.

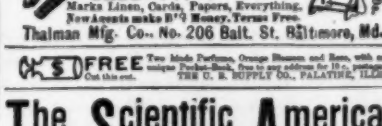
STEEL TYPE FOR TYPEWRITERS

Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks., 100 Nassau St., N.Y.

FOR SALE.—Patent on the Toy Pistol described on page 339 this issue. Best thing out for holidays. Address CHAS. BLAMPIED, JAMAICA PLAINS, MASS.

ODELL Double Case TYPE WRITER Only $30.
It has 78 Characters, and is the only Type Writer with Check Perforator attachment. Is fast taking the lead of all Type Writers. Larger sales than all others combined. Send for circulars.
ODELL TYPE WRITER CO., 95 Fifth Av., Chicago.

IMPERIAL P. & P. Stamp with name 10 cts.



CLUB of 14 postpaid for $1 bill. Marks Linen, Cards, Papers, Everything. New Agents make $4 Money. Terms Free.
Thalman Mfg. Co., No. 206 Balt. St. Baltimore, Md.

FREE Two Made Perfume, Orange Blossom and Rose, with an unique Pocket-Book, free to any address for 10 cts. postage. THE U. S. SUPPLY CO., PALATINE, ILL.

The Scientific American
PUBLICATIONS FOR 1891.

The prices of the different publications in the United States, Canada, and Mexico are as follows.

RATES BY MAIL.

The Scientific American (weekly one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
The Scientific American, Spanish Edition (monthly) one year	3.00
The Scientific American, Architects and Builders Edition (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement	$7.00
The Scientific American and Architects and Builders Edition	5.00
The Scientific American, Supplement, and Architects and Builders Edition	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

Popular Books
—FOR THE—
HOLIDAYS.

Experimental Science.—By Geo. M. Hopkins. Natural Philosophy without a Teacher Simplified. Interesting Experiments in Every Branch of Physics Descriptions of Simple and Efficient Apparatus, much of which may be Made at Home. Among Subjects treated are Electricity in all its Branches, Magnetism, Heat, Light, Photography, Microscopy, Optical Illusions, Mechanics, etc. A world of Valuable Information. A Source of Rational Amusement. A superb work for Young and Old. 740 pages, nearly 700 first class engravings. Elegantly bound in cloth.....**$4.00**

Popular Scientific Recreations.—Translated and enlarged from the French of Gaston Tissandier, and profusely illustrated. This book includes the famous series of Experiments in Physics Without Apparatus, that have won such wide appreciation in so many households. Experiments in Physics and Chemistry, Natural Magic, Electricity, and similar subjects are all treated and very fully illustrated with the most artistic woodcuts. 200 cuts. 780 large pages. Holiday edition. Half leather, gilt top.....**$4.00**

Cyclopædic Science Simplified.—By J. H. Pepper. With over 400 illustrations. Treating on Light, Heat, Electricity, Magnetism, Pneumatics, Acoustics and Chemistry.....**$2.50**
This is an excellent work.

Boys' Book of Science.—The Boys' Book of Science, by John Henry Pepper, author of the "Playbook of Metals." Illustrated with 453 engravings, chiefly executed from the author's sketches. By H. G. Hine. Revised, with many additions, by T. C. Hepworth. New edition.....**$2.00**

Home Experiments in Science.—By T. O'Conor Sloane, E.M., A.M., Ph.D. Illustrated by 91 engravings. 260 pages.....**$1.50**

SYNOPSIS OF CONTENTS: Chapter I. Experimental Science. II. Mechanical Operations. III. Experiments in Mechanics. IV. Experiments in Gravitation, Hydraulics and Pneumatics. V. Atoms and Molecules. VI. Experiments in Molecular Physics. VII. Experiments with Soap Bubbles. VIII. Experiments in Heat, Sound, and Light. IX. Lecturing. Index.

Electricity in Daily Life.—A Popular Account of the Application of Electricity to Every Day Uses. With 120 illustrations. 8vo.....**$3.00**

In this work eminent experts treat in a popular manner of the Electric Railway, Motors, Lighting Telegraphs, Cables and their Laying, Electricity in the Household, in Warfare, on Land and Sea, and as applied to the Human Body.

Electricity in the Service of Man.—A Popular and Practical Treatise on the Applications of Electricity in Modern Life. By A. R. Von Urbanitzky. From the German. Edited with copious additions by L. Wormell, and an Introduction by John Perry, M.E. With 850 illustrations. 8vo, cloth. N. Y., 1890.....**$6.00**

Practical Electricity.—A Treatise for the Use of Students of Electrical Engineering, teaching how to procure a Knowledge of the Electric Current, Difference of Potential, Resistance, Electromotive Force, Quantity, Capacity, Power, etc. By W. E. Ayrton, F.R.S. With numerous illustrations, diagrams, and formulæ. A valuable work. 348 pages, 8vo.....**$2.50**

Electrical Engineering.—By W. Slingo and A. Brooker. A Practical Book for Electric Light Artisans and Students. This is a Comprehensive Treatise on the more Important Modern Applications of Electricity. 630 pages. 300 illustrations.....**$3.50**

Electrical Dictionary.—By Edwin J. Houston. A Dictionary of Electrical Words, Terms, and Phrases. Brief Descriptions of Principles, Apparatus, Machinery and Instruments, Tables, Formulæ, etc. A desirable book. Fully illustrated.....**$2.50**

Dynamo-Electric Machines.—By Carl Hering. Principles of, and Practical Directions for Designing and Constructing Dynamos, with an Appendix containing several Articles on Allied Subjects, and a Table of Equivalents of Units of Measurement. Illustrated. N. Y., 1888.....**$2.50**

Haswell's Engineers' Pocket Book.—Engineers' Pocket Book. Mechanics' and Engineers' Pocket Book of Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics: including Areas, Squares, Cubes, and Roots, etc.; Logarithms, Hydraulics, Hydrodynamics, Steam and the Steam Engine, Naval Architecture, Masonry, Steam Vessels, Mills, etc.; Limes, Mortars, Cements, etc.; Orthography of Technical Words and Terms, etc. Fifty-second edition. By Chas. H. Haswell. 12mo, pocket book form.....**$4.00**

Engineers' Handy Book.—Containing a full Explanation of the Steam Engine Indicator, and its Use and Advantages to Engineers and Steam Users: with Formulæ for Estimating the Power of all classes of Steam Engines: also, Facts, Figures, Questions, and Tables for Engineers who wish to qualify themselves for the United States Navy, the Revenue Service, the Mercantile Marine, or to take charge of the better class of Stationary Steam Engines. One volume. Second edition. 675 pages. 16mo, tucks, gilt edge.....**$3.50**

The Practical Steam Engineer's Guide.—In the Design Construction and Management of American Stationary, Portable, and Steam Fire Engines, Steam Pumps, Boilers, Injectors, Governors, Indicators, Pistons and Rings, Safety Valves and Steam Gauges. For the Use of Engineers, Firemen, and Steam Users. By Emory Edwards. Illustrated by 119 Engravings. Third Edition, revised and corrected. 420 pp. 12mo....**$2.50**

Every Man His Own Mechanic.—A Complete Guide for Amateurs. New Holiday Edition, revised and greatly enlarged. With an Appendix. 324 pp. 850 wood cuts. 8 Working Drawings. (1890.) Price.....**$3.50**

Gems and Precious Stones of North America.—A Popular Description of their Occurrence, Value, History, Archæological, and of the Collections in which they Exist, also a Chapter on Pearls, and on Remarkable Foreign Gems owned in the United States. By George Frederick Kunz. New York, 1890. Pp. 325. Illustrated with 8 colored plates and numerous engravings. Price.**$10.00**

Practical Microscopy.—By G. E. Davis. A Desirable Work. Illustrated. 8vo **$3.00**

Carpentry Made Easy: or, The Science and Art of Framing on a New and Improved System. With Specific Instructions for Building Balloon Frames, Barn Frames, Mill Frames, Warehouses, Church Spires, etc. Comprising also a System of Bridge Building, with Bills, Estimates of Cost, and valuable Tables. Illustrated by 44 plates, comprising nearly 200 figures. By William E. Bell, Architect and Practical Builder. 8vo.....**$5.00**

☞ Any of the above books promptly sent by mail, postpaid, on receipt of the price, by

MUNN & CO.,
Publishers of the "Scientific American,"
361 Broadway, New York.

☞ *Send for our New and Complete Catalogue of Books, sent free to any address.*

Advertisements.

Inside Page, each insertion - - - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in *agate* type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Victor Bicycles!

For pleasure, business, recreation, and for anything you could use a bicycle for.

VICTORS ARE BEST!

Send for catalogue.

Overman Wheel Co., Makers,

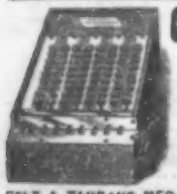
Chicopee Falls, Mass.

SMALL ELECTRIC MOTOR FOR AMateurs.—By C. D. Parkhurst. Description in detail of a small and easily made motor powerful enough to drive a ten or twelve inch brass fan and to give a good breeze. With 15 figures drawn to a scale. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 767. Price 10 cents. To be had at this office and from all newsdealers.

BELTING Something New

More flexible and nine times stronger than leather. Is not affected by wet, dry, or heat. Send your name and address for price list and description to THE MIDGLEY WIRE BELT CO., OF BEAVER FALLS, PENNA., U. S. A. Responsible agents wanted to sell this new invention, covered by more than twenty patents, here and all over Europe. In writing name this paper.

BELTS



COMPTOMETER

ALL ARITHMETICAL PROBLEMS

Solved rapidly and accurately by using the COMPTOMETER. Saves 40 per cent. of time. Entire relief from mental strain. Adapted to all commercial and scientific computations. Send for circular.

FELT & TARRANT MFG. CO., 52-56 Illinois St., Chicago.

THE MODERN ICE YACHT. — BY Geo. W. Polk. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 644. Price 10 cents. To be had at this office and of all newsdealers.

NEW KODAKS

"You press the button, we do the rest."

Seven New Styles and Sizes

ALL LOADED WITH *Transparent Films.*

For sale by all Photo. Stock Dealers.

THE EASTMAN COMPANY,

Send for Catalogue. ROCHESTER, N. Y.

A NEW CATALOGUE —OF— VALUABLE PAPERS

Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent free of charge to any address.

MUNN & CO., 361 Broadway, New York.

Barrel, Keg, Hogshead AND STAVE MACHINERY.

Over 50 varieties manufactured by

E. & B. HOLMES,

BUFFALO, N. Y.

Also a full line of Wood Working Machinery.

Chamfering, Howelling, and Crozing.

STEREOTYPING; THE PLASTER AND Paper Processes.—Composition and preparation of the mould, the best alloys of metal and proper degree of heat, trimming and mending the plate, etc. A minute description of both processes, with numerous illustrations. A paper of great interest to every printer. By Thomas Bolas, F.C.S., F.I.C. SCIENTIFIC AMERICAN SUPPLEMENTS, 773 and 774. 10 cents each.

NICKEL AND ELECTRO-PLATING APPARATUS AND MATERIAL

HANSON, VAN WINKLE & CO.

NEWARK, N.J.

92 LIBERTY ST. N.Y.

PATENTS!

MESSRS. MUNN & CO., [illegible] with the publication of the SCIENTIFIC [illegible] continue to examine improvements, and [illegible] Solicitors of Patents for Inventors.

In this line of business [illegible] had *forty-one years'* experience, and now h[illegible] *facilities* for the preparation of Patent [illegible] specifications, and the prosecution of Appli[illegible] Patents in the United States, Canada, and [illegible] tries. Messrs. Munn & Co. also attend to the [illegible] of Caveats, Copyrights for Books, Labels, R[illegible] signments, and Reports on Infringements of Pa[illegible] All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,

361 Broadway, New York.

BRANCH OFFICES.—No. 625 and 626 F Street, Patents Building, near 7th Street, Washington, D. C.

H. W. JOHNS'

ASBESTOS SECTIONAL PIPE COVERING.

A Non-Conducting Covering for Steam and Hot Water Pipes, etc.

READILY ATTACHED OR REMOVED BY ANY ONE.

ASBESTOS BOILER COVERINGS.

We are prepared to take contracts for applying *Steam Pipe and Boiler Coverings in any part of the United States.*

H. W. JOHNS MANUFACTURING COMPANY,

SOLE MANUFACTURERS OF

H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, etc.

87 Maiden Lane, New York. CHICAGO. PHILADELPHIA. BOSTON.

"Improvement the order of the age."

THE SMITH PREMIER TYPEWRITER

Important Improvements.

All the Essential Features greatly perfected.

The Most Durable in Alignment.

Easiest Running and Most Silent.

All type cleaned in 10 seconds without soiling the hands.

The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.

Send for Catalogue.

Hoskins' Patent Hydro-Carbon

BLOW-PIPE AND ASSAY FURNACES.

No dust. No ashes. Cheap, effective, economical, portable, and automatic.

Send for Price List.

W. Hoskins, 89 S. Clark St., Room 50, Chicago, Ill.

JENKINS BROS. VALVES!

JENKINS BROS., 71 John St., N. Y.; 105 Milk St., Boston; 21 North 5th St., Phila.; 54 Dearborn St., Chicago.

2 to 40 H. P.

The Motor of 19th Century

Can be used *Any Place*, to do *Any Work*, and by *Any One*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address

Economy, Reliability, Simplicity, Safety.

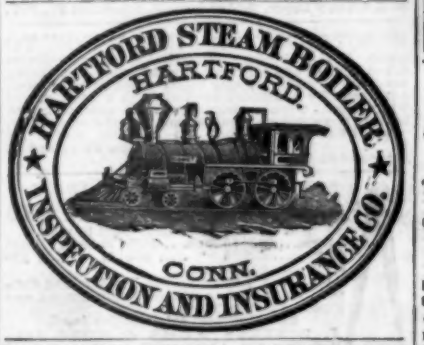
Charter Gas Engine Co.

P. O. Box 145. Sterling, Ill.

Levels, Transits, Surveyors' Compasses, Pocket and Prismatic Compasses, Hand Levels, Angle Mirrors, Planimeters, Pantographs, Engineers' Slide Rules, Leveling Rods, Poles, Chains, etc.

Catalogue on application.

VELOCITY OF ICE BOATS. A COLLECtion of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 214. Price 10 cents. To be had at this office and from all newsdealers.



ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 1. The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

MOSS ENGRAVING COMPANY 535 PEARL ST. COR. FULTON N.Y.

OUR PROCESSES: MOSS-TYPE, PHOTO ENGRAVING, ZINC ETCHING. WE DO FINE PRESS WORK.

Engravings direct from photographs and other copy. Our circular "N" shows specimens. Fine printing a specialty.

CUTLER DESK. BEST IN THE WORLD. A. CUTLER & SON, BUFFALO, N.Y. U.S.A.

SEWING MACHINE MOTOR FOR AMAteurs.—By C. D. Parkhurst. Description of a very simple and effective motor, with laminated armature, of sufficient power to actuate a sewing machine. With 11 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 759. Price 10 cents. To be had at this office and from all newsdealers.

Our SIGHT-FEED

GLASS OIL CUP

Fig. 306,

Will just suit you. Write for complete Catalogue.

The Lunkenheimer Brass Mfg. Co.,

15-17 E. 8th St., CINCINNATI, O.

THE AMERICAN BELL TELEPHONE CO.

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

The most Successful Lubricator for Loose Pulleys in use.

VAN DUZEN'S PATENT LOOSE PULLEY OILER

Highly recommended by those who have used them for the past four years. Prices very reasonable. Every user of machinery should have our "Catalogue No. 16," sent free. Mention this paper.

VAN DUZEN & TIFT, Cincinnati, Ohio.

THE MARINE LOCOMOTIVE.—BY A. Huet. Description of a vessel supported and propelled by revolving drums. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 755. Price 10 cents. To be had at this office and from all newsdealers.

INVENTIONS WORKED OUT. Drawings and Models made. Perfect safety to inventors assured. All kinds first-class lathe, planer, and bench work. Particular attention to special machinery, tools, dies, and press work. Safety Construction Co., 145 & 145 Elm St., N.Y.

GATES ROCK & ORE BREAKER

Capacity up to 150 yards per hour.

Has produced more ballast, road metal, and broken more ore than all other Breakers combined.

Send for Catalogues.

CATES IRON WORKS

50 C So. Clinton St., CHICAGO.

215 Franklin St., Boston, Mass.

44 Dey Street, New York.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

PRACTICAL BUSINESS TYPEWRITERS AT A LOW PRICE

Catalogue free. Address Typewriter Department, POPE MFG. CO., Boston, New York, Chicago.

COMPLETE STEAM PUMP
10 SIZES FROM $7 TO $75
FOR WATER SUPPLY TANKS, FIRE PUMPS & ETC.
WRITE FOR PRICES AND DESCRIPTIVE CIRCULARS
VAN DUZEN & TIFT
SOLE MAKERS
CINCINNATI, O.

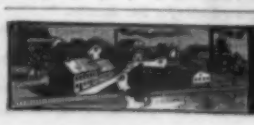
ROOFING!

GUM-ELASTIC ROOFING FELT costs only $2.00 per 100 square feet. Makes a good roof for years, and any one can put it on. Send stamp for sample and full particulars.

GUM ELASTIC ROOFING CO.,

39 & 41 West Broadway, New York.

LOCAL AGENTS WANTED.



THE FRED'K CRANE CHEMICAL CO.

SHORT HILLS, N. J.-BOX 91A-

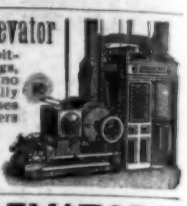
ZAPONS, BRUSH & DIP, LACQUERS, VARNISH, SHELLACS, BLACKS, BRILLIANT & DEAD JAPANS, AIR DRYING, ENAMELS, TRANSPARENT, FOR METAL AND WOOD, PROOF AGAINST

SYRACUSE MALLEABLE IRON WORKS

W. B. BURNS, PROP'R

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

The OTIS Electric Elevator



for Private Residences, Hospitals, Small Office Buildings, Stores, etc. It is safe, simple (no Engineer required), practically noiseless. Running expenses very light. Also manufacturers of the Standard Hydraulic Passenger and Freight, Steam and Belt Elevators.

Otis Brothers & Co.,

38 Park Row, New York

GRAVES ELEVATORS.

PASSENGER & FREIGHT L. S. GRAVES & SON ROCHESTER N.Y.

NEW YORK. BOSTON. CHICAGO. PITTSBURG.

WORKING MODELS and Experimental Work. New inventions worked out. Small machinery built in iron or brass. Working drawings made. Aug. Zaubitz, 48 Centre St., N. Y.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's Book of SAWS, new 1890 edition. We are first to introduce NATURAL GAS for heating and tempering Saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.

SAWS SAWS SAWS SAWS

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS. FINE TINNING, JAPANNING AND BRONZING.

THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

THE

Scientific American

ESTABLISHED 1846.

The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,

361 Broadway, New York.

THE

Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check.

MUNN & Co., 361 Broadway, N. Y.

Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture**, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,

361 Broadway, New York.

PRINTING INKS.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.